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Advertisement Index, see page xxxvi.

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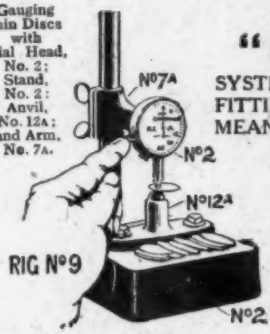

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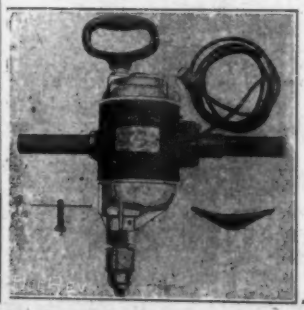

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ELECTRICAL REVIEW.

Vol. LXXXVIII.] CONTENTS: May 6, 1921. [No. 2,267.

	Page
The Electrical Manufacturing Industry	573
Sale of Goods under a Trade Mark	574
The Electrification of Railways	574
Submarine Cable Telegraphy, by E. Raymond-Barker (*illus.*).	575
Determination of Equivalent Resistance and Copper Losses in a Three-phase Stator, by A. Nash (*illus.*)	576
The Work of the Electricity Commissioners	577
Engineering in Russia	578
Correspondence—	
Electricity Supply without Statutory Powers	578
Charging for Idle Current	578
The Training of Kinema Operators	579
Transformers and Changed Frequency	579
Domestic Tariffs and Cheap Metering	579
The Hackney Case	579
Nottingham's Electricity Supply	579
The Transport of Coal by Suction	579
Business Notes	580
Notes...	588
City Notes	591
Stocks and Shares	593
Market Quotations	593
The Industrial Situation in Sweden	597
Magnetos for Internal-combustion Engines, by A. E. Watson (*illus.*)	598
The Industrial Application of Variable-speed Motors, by Dr. S. Parker Smith	600
The Underground Railway Training School (*illus.*)	601
The Institute of Physics	601
The Use of X-Rays for Testing Materials	602
Legal	603
New Patents Applied for, 1921	604
Abstracts of Published Specifications	604
Contractors' Column ... ... Advertisement page	xxvi

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THE ELECTRICAL MANUFACTURING INDUSTRY.

AT annual meetings held during the last fortnight by two of the largest British electrical manufacturing companies, statements have been made which amply justify the optimistic views which have appeared in these pages recently respecting the electro-industrial situation.

It is important that we should remember the very special place occupied by the electrical industry in relation to all or most other trades, and the service which it is peculiarly designed to render them in their own progress toward more economical and efficient production. It is very easy to allow the heavy clouds which overhang most nations to-day to depress us unduly and lead us to hold our hand from even some of the most ordinary measures of enterprise if we forget that the essential service that it exists to provide places it in a unique position. If we can contrive means for passing through the present critical period with comparatively little damage to our manufacturing business we shall reach such a state of activity as the industry has never before known.

What Sir Charles Ellis said at the meeting of the English Electric Co., Ltd., with regard to railway electrification is equally applicable to much other work that will sooner or later fall for execution. The delay in proceeding with the electrification of railways in the United Kingdom—work which means so much to the future of the industry—is not due to any doubt as to the technical advantages that accrue from the adoption of electric traction; it is mainly due to difficulties of finance. The depression that affected other important national industries last autumn, began noticeably to affect the electrical trade a little later, but the company in question has a considerable volume of unexecuted orders, and, said Sir Charles, "it is not unreasonable to hope that in all except the smaller classes of our manufactures the flywheel action of this volume of orders will be sufficient to carry us over until trade revives." The speaker stated that one of the causes of the present trade depression was the loss of orders to foreign competitors consequent in part upon the wage rates now prevalent in British engineering and "even more" in the industries from which it draws its materials. He showed, as did Mr. Bryce at the meeting of the Metropolitan-Vickers Co., that if we are to extend or even fully to regain our pre-war business abroad, considerable reductions will be necessary in the prices of our products, "and therefore in the cost of the whole range of processes through which they are built up from the materials of coal and iron." Sir Charles has no doubt whatever that we shall be able to negotiate the present crisis safely if both employers and workers can be sure that the necessary sacrifices are distributed as fairly and equitably as is humanly possible over all those concerned.

That there will be a revival of trade sooner or later, notwithstanding the very exceptional causes of the prevailing depression, there is no room for doubt, and when it does come the electrical industry will assuredly contribute in a remarkable way to securing appropriate reward for all classes and all craftsmen. "The electrical industry has an assured future, because it is bound up with those improvements and economies in

productive organisation which we all regard as a necessary element in the future prosperity of the world."

For the record of what the English Electric Co. has been doing during the past year by way of consolidating its organisation, and developing at its several factories the manufacturing operations for which they are each most suited—in other words, "the best possible utilisation of our five works"—we must refer readers to our "City Notes" pages to-day. Efficiency of equipment and organisation, "continuous team work by the staffs," discussion of labour problems through works committees, and economy in selling expenses at home and abroad—these are the outstanding features of the work that occupied the year that has gone.

The record of the Metropolitan-Vickers Co. printed in our last issue indicated that the orders received in 1920 were about 80 per cent. greater in value than those of the preceding year, and the orders completed were 50 per cent. greater. The actual tonnage of orders completed, which is perhaps more suggestive than value nowadays, represented an increase of about 30 per cent., and as Mr. Bryce pointed out, this was a remarkable improvement, seeing that electrical machinery is always becoming lighter in weight, owing to the increase of efficiency in the use of the materials of construction, and he justifiably mentioned it as reflecting very great credit on the efficiency of the organisation.

It is obvious that while neither of the two great electrical manufacturing concerns to which we refer can see any grounds for exultation as long as the home industrial and financial situation is so depressing, and the state of international questions causes general unsettlement, they are both, like probably many other electrical firms, living in anticipation of great times that may not be far off.

Mr. A. F. Berry, of the British Electric Transformer Manufacturing Co., Ltd., rightly said the other day that the next few years would test the capacity of even the best captains of industry, and he remarked that it would be most difficult to restart businesses that had stopped, or speed up those which had slowed down. There is undoubtedly a distinct danger in slowing down, and it should not be done without the fullest deliberation.

We are inclined to give a word of warning lest, due to the adverse conditions of the moment, there be a tendency to permit the instruments of electrical commerce to rust, to dispense with men essential to the best enterprise when the awakening comes, to defer the preparation of measures for securing efficient salesmanship. These are matters in connection with which the wheels cannot be set running efficiently again in a hurry if we have indulged in a little slacking off. We cannot afford to slow down in our efforts to keep in touch with buyers either at home or abroad. The prices of our product must come down sooner or later, and we shall be the better able to take advantage of reductions if our salesmanship, publicity, and general business-getting organisation be continuously maintained in a state of high efficiency.

Sale of Goods Under a Trade Mark.

A point of considerable importance to those who buy goods having a trade mark was decided in the Court of Appeal some time ago. The question was:—What is the effect of a sale of goods which bear a label which is an infringement of the trade mark of some third person? The defendants sold to the plaintiffs certain cases of condensed milk. Some of the tins were labelled with the "Nissly" brand. After the transaction was completed, the plaintiffs found that the label was an infringement of the trade mark of Nestlé Co. In these circumstances they were compelled to sell the tins at a loss, having first removed the offending labels. They sought to recover damages from the defendants. By Sec. 12 of the Sale of Goods Act, 1893, "In a contract of sale, unless the circumstances of the contract are such as to show a different intention, there is: (1) An implied condition on the part of the seller that in the case of a sale he has a right to sell the goods, and that in the case of an agreement to sell he will have a right to sell the goods at the time when the property is to pass. (2) An implied warranty that the buyer shall have and enjoy quiet possession of the goods. . . ." Mr. Justice Bailhache held that when without the knowledge of the buyer or of the seller goods are labelled in such a way that they cannot in their then condition be resold without infringing the trade mark of a third party, the above provisions do not entitle the buyer to reject the goods. In coming to this conclusion the learned judge followed the decision of Lord Russell of Killowen in Monforts *v.* Marsden, 12 R.P.C. 266. The Court of Appeal has now reversed this decision, holding that there was an implied condition on the part of the seller that the defendant would have the right to sell the goods, and that this condition had been broken. It is useful to note that this decision is not based upon Sec. 17 of the Merchandise Marks Act, 1887, under which on the sale or in the contract for the sale of any goods to which a trade mark or marks or trade description has been applied the vendor is deemed to warrant that the mark is genuine and not forged or falsely applied.

It was decided in an earlier case (by Mr. Justice Rowlatt), Scaliaris *v.* Ofverberg, 37 T.L.R. 307, that when goods are sold as being of a particular brand, the undertaking is that they will bear the label of the manufacturer which is put on the goods of that brand in the ordinary course of business, and there is no obligation on the purchaser to accept goods which do not bear the label, even though the goods of that brand have been made by that particular manufacturer.

The Electrification of Railways.

The recent decision of the Ministry of Transport to standardise the use of the high-pressure direct-current system for the electrification of our railways suggests the inference that the battle between a.c. and d.c. has terminated definitely in favour of the latter. This conclusion, however, is by no means so well established as might be thought. In an article published in the *Electrical World*, Herr E. C. Zehme, of Berlin, points out that the electrification of railways in Germany, Sweden, Norway, Holland, and Italy is "somewhat in suspense," on account of the lack of a definite decision as to the type of current to employ. Switzerland and Austria have officially adopted the single-phase system at 15,000 volts, with a frequency of 15 or $16\frac{2}{3}$ cycles per second, but in each country one-third of the existing mileage that is electrically operated is working on the d.c. system; in both cases the electrification of the railways is of extreme urgency, owing to the lack of native coal, and huge schemes with that end in view have been approved.

Sweden also has favoured the single-phase system, but has experienced considerable trouble due to inductive disturbances in telegraph and telephone lines, which constitute a grave objection to the use of alternating current. Holland has not yet decided upon the choice of system. In Italy all three systems—d.c., three-phase and single-phase—are widely used, in the order named, and a special ministry has been formed to consider a great extension of electrification, with a leaning towards three-phase, which has attained its greatest development in that country.

Germany has used single-phase on recent electrifications, but here again serious inductive troubles have been met with, as well as operating difficulties, and doubts have been expressed as to the wisdom of adopting alternating current. In the United States, direct current has been in the ascendant for some years.

It is clear, therefore, that the question is still by no means settled; the three-phase system, curiously enough, is not making much progress, and the fight is practically confined to the two great rivals, direct current and single-phase current, which so long disputed the supremacy for lighting purposes in this country.

SUBMARINE CABLE TELEGRAPHY.

Oscillatory Circuit Signal Conditions: Some Graphs, Tables, and Scales.

By EDWARD RAYMOND-BARKER.

1. The foregoing sub-title certainly is somewhat lengthy, and readers may opine that, at least, the collective term "some" might have been omitted. That this word is requisite is due to the fact that the following matter—once certain preliminary points shall have been dealt with—will relate to one sub-section, only, of the complex system of submarine cable station electrical adjustments

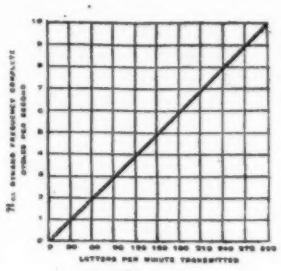

FIG. 1.

A	B	C	D	E.	F.
∩ p.m. c.h.p.m.	l.p.m.	$\frac{\text{l.p.m.}}{15} =$ ∩ per sec.	$\frac{15}{\text{l.p.m.}} =$ Sec. per ∩.	$\frac{\text{l.p.m.}}{30} =$ ∿ per sec.	$\frac{30}{\text{l.p.m.}} =$ Sec. per ∿.
200	50	3.333	0.300	1.667	0.6000
300	75	5.000	0.200	2.500	0.4000
400	100	6.667	0.150	3.333	0.3000
500	125	8.144	0.123	4.167	0.2400
600	150	10.000	0.100	5.000	0.2000
700	175	11.667	0.0857	5.833	0.1714
800	200	13.333	0.0750	6.667	0.1500
900	225	15.000	0.0667	7.500	0.1333
1000	250	16.667	0.0600	8.333	0.1200
1100	275	18.333	0.0545	9.167	0.1066
1200	300	20.000	0.0500	10.000	0.1000
1300	325	21.667	0.0462	10.833	0.0923
1400	350	23.334	0.0429	11.667	0.0857
1500	375	25.000	0.0400	12.500	0.0800
1600	400	26.667	0.0375	13.333	0.0750
1700	425	28.334	0.0353	14.167	0.0706
1800	450	30.000	0.0333	15.000	0.0667
1900	475	31.667	0.0316	15.833	0.0631
2000	500	33.334	0.0300	16.667	0.0600
2100	525	35.000	0.0286	17.500	0.0571
2200	550	36.667	0.0273	18.333	0.0545
2300	575	38.334	0.0261	19.167	0.0522
2400	600	40.000	0.0250	20.000	0.0500
2500	625	41.657	0.0240	20.833	0.0480
2600	650	43.333	0.0231	21.667	0.0462
2700	675	45.000	0.0222	22.500	0.0444
2800	700	46.667	0.0214	23.333	0.0429
2900	725	48.334	0.0207	24.167	0.0414
3000	750	50.000	0.0200	25.000	0.0400

TABLE I.

widely-flung band of devoted and experienced men (what is mere geographical distance when mutual concern in an interesting subject unites all in one?) who, at the present moment, dotted here and there over the world of land and ocean, under modern technical conditions of high tension not unattended by personal anxiety, keep the working of the world's great cables up to concert pitch, the present writer, notwithstanding his varied experience ashore and afloat, feels a mere neophyte.

4. However, some little time ago, having had his attention drawn to the afore-mentioned sub-section of what really is a big subject, he thereupon devised, and eventually found useful certain graphic methods and curves which indicate the mutual relativity of K and L at various speeds. These graphs have since proved of great use. It is a record of this little investigation, together with resulting *tables*, *curve sheets*, and *calibrated scales*, as best may suit the reader's preference, that the writer has much pleasure in submitting, through the columns of the ELECTRICAL REVIEW, to all friends interested.

5. It will be, of course, clearly understood that the only novelty claimed by the writer—in which particular direction he is not aware that he has been anticipated—lies not in any new process of calculation, but in the presentation in tabulated, and more especially, *in graph form*, or by means

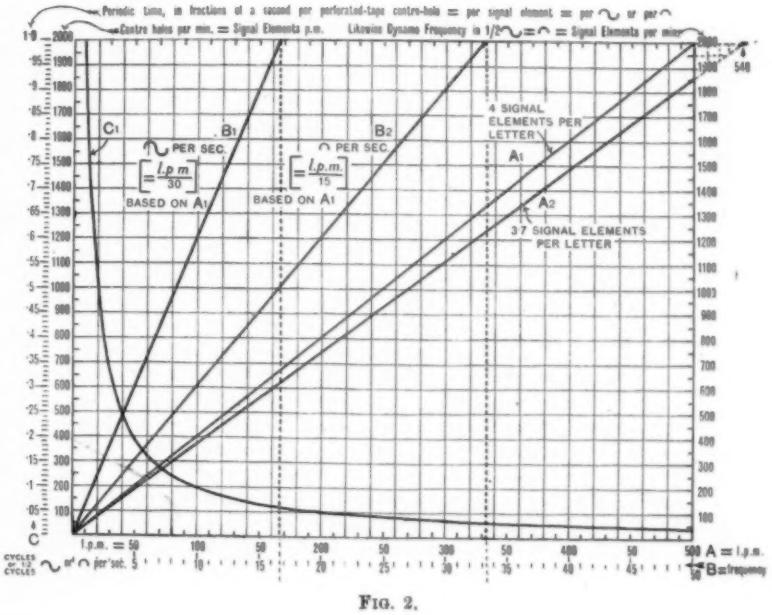
Periodic time, in fractions of a second per perforated-tape centre-hole = per signal element = per ∿ or per ∩
Centre holes per min. = Signal Elements p.m. Likewise Dynamo Frequency in ∿/∩ = Signal Elements per min.
C1
B1
B2
PER SEC.
[= l.p.m. / 30]
BASED ON A1
PER SEC.
[= l.p.m. / 15]
BASED ON A1
4 SIGNAL ELEMENTS PER LETTER
A1
A2
37 SIGNAL ELEMENTS PER LETTER
l.p.m. = 50
A = l.p.m.
B = frequency

FIG. 2.

and corrective devices of late years grown up owing to modern requirements with regard to high-speed cable-signal transmission and reception, auto-retransmission, and—whenever desirable—ultimate Creed record in Roman type.

2. The said sub-section will be found to refer to the relationship or relativity desirable between capacity K (microfarads) of the receiving condenser, and inductance L (henries) of the receiving inductance shunt between cable and receiving apparatus (to be illustrated later), whenever permanent maintenance of any particular speed of effectively shaped-up signal impulses, or—expressed in another way—any particular frequency in complete cycles or waves transmitted and received per second, is desired. The circumstance, therefore, that this sub-section forms only a small portion of cable reception oscillatory circuit matter considered generally, clearly justifies the foregoing qualifying expression "*some* graphs."

3. In the presence, so to speak, of the scattered and

of calibrated scales, of calculated values resulting from theories and methods already known to and used by cable staffs. These graphs, and any tables corresponding to the same, will remain—at least, so the writer ventures to hope—a permanency for quick and easy reference at any time, or as models for others at any particular speeds required, to the great simplification of the work of quickly estimating not a few electrical adjustments.

6. Already, reference has been made to the necessity, first of all, for dealing cursorily with certain preliminary matter. This covers mainly:—

7. (A.) The requisiteness, on any coherent submarine-cable electrical-signal transmitting and reception plants, of synchronic coincidence, between the several frequencies in terms of complete cycles (∼) per second, of three separate, though co-operating, pulsatory systems, namely (*a*): Frequency of signal beats in terms of complete waves or cycles per second; (*b*) frequency pertaining to the natural period

of free electrical oscillations in the receiving oscillatory system, namely, that consisting of receiving condenser in series with actual receiver, these two instruments being shunted by a self-inductive resistance coil, inductance or magnetic shunt; (*c*) frequency pertaining to the natural period of vibration of the actual receiver, whether this be a direct-working recorder or other apparatus on local circuit. As a matter of fact, the last-mentioned of these frequencies, especially that of a local circuit instrument, may be, with advantage, somewhat of a higher order than in the case of the prior two, viz. (*a*) and (*b*).

8. (B.) Conversion of perforated-slip *centre holes per minute* (c.h.p.m.) into machine-transmitted *letters per minute* —hereafter to be referred to as l.p.m.—and thence into equivalent *complete cycles or waves per second.*

9. Let us, first of all, deal with (B). In former times, leading authorities, *e.g.*, the Eastern Telegraph Co.'s Electrical Department, took the average recorder code letter corrected for spacing as amounting to 3·7 contact elements per letter. In "Notes" in *The Electrician* of April 23rd, 1897, the following concise information is given:—

10. . . . "At stations where the automatic transmitter is used, the letter speed per minute can readily be arrived at by counting the number of centre-holes in the perforated slip which pass through the transmitter in one minute, and dividing that number by the constant 3·7 representing the number of spaces occupied by an average letter. This constant 3·7 has been arrived at by a careful examination of the traffic carried by the Eastern and other systems, and by calculating the actual number of electrical contacts which are made in the formation of an average letter, which is found to be within 3 per cent. of 2·6. To this figure must be added 1·0 for the space between each letter, and 0·1 for the proportion to be added to each letter on account of the extra space allowed between words—a word for this purpose being taken as 10 letters."

11. Of recent years the constant 3·7 contacts per letter has given place to the constant of *4 contacts per letter.* For instance, Colonel George O. Squier, Ph.D. (now Major-General, Signal Corps, U.S. Army), in the memorable paper "On an Unbroken Alternating Current for Cable Telegraphy," read by him on June 25th, 1915, before the Physical Society of London,* has given a graph, fig. 1 (General Squier's fig. 3), exhibiting the linear relation between *n*, the frequency of a transmitting single-phase alternator, and the letters per minute transmitted, based on the assumption that the average cable letter with its space is equivalent to *4 contact signals.*

12. In a very useful paper entitled "The Practical Problem of Telegraph Transmission from a New Angle of View," contributed to the Royal Engineers' *Journal* (October, 1915) by Major W. A. J. O'Meara, C.M.G., endorsing and supporting Colonel Squier's sine-wave alternating-current system of submarine-telegraph transmission and reception, Major O'Meara, on page 188, refers to 386 signals per minute as = 19 words per minute. This means that 386/19 = 20 signals per word, and 20/5 letters per word = *4 signals* per letter.

13. The British Post Office "Imperial Cable" Service, the Eastern Telegraph Co.,† the Compagnie Française des Câbles Télégraphiques, and, doubtless, other administrations, have adopted the standard of 4 contacts per letter, including space.

14. Thus, an average cable-code letter with its space
= 4 signal contact units.
= 4 centre-holes of perforated slip.
= 4 half cycles (⌒).
= 2 complete cycles (~).

15. Again, referring back to 8:—
l.p.m./60 = letters per second.

16. L.p.sec. × 4 = signal contact units per sec.
= ½ cycles (⌒) per sec.

17. ½ cycles per sec./2 = complete cycles (~) per sec.

18. So, in conversion of l.p.m. to complete cycles (~) per sec.—l.p.m. ÷ 60 × 4 ÷ 2 = ~ per sec.

19. But this is equivalent to—l.p.m. ÷ 30 × 2 ÷ 2 = ~ per sec.

20. Which is tantamount to—l.p.m. ÷ 30 = ~ per sec.
l.p.m. ÷ 15 = ⌒ per sec.

21. Table I will be found usefully comprehensive.
Column A gives transmission speeds in c.h.p.m. = ⌒ p.m.
„ B equivalent l.p.m.
„ C equivalent ⌒ per sec.
„ D recip. of C = duration of ⌒.
„ E true frequency of oscillations = ~ per sec.
„ F recip. of E = periodic time of each ~.

22. Chart shown in fig. 2 embodies, in graph form, methods utilised for compilation of Table I.

Line A_1, using ordinate scale c.h.p.m., and abscissa scale A, converts c.h.p.m. into l.p.m., and *vice versa*, on the basis of four centre holes to one cable-code letter.

Line A_2 similarly, but on basis of Eastern Telegraph Co.'s former constant of 3·7 centre holes to one cable-code letter.

Line B_1, using ordinate scale c.h.p.m., and abscissa scale B, converts c.h.p.m. to frequency ~ per sec., and *vice versa*, on basis of four centre holes to one letter.

Line B_2 similarly converts c.h.p.m. into ⌒ per sec., and *vice versa.*

Reciprocal curve C_1, using ordinate scale C, and abscissa scale B, converts periodic time in fraction of a sec. per ~ to frequency ~ per sec., and *vice versa*, or, if required, sec. per ⌒ to ⌒ per sec., and *vice versa.*

Example:—(Using, on the chart, a pair of compasses) 1,700 c.h.p.m. = 425 l.p.m. = 14·2 ~ per sec. = 0·071 sec. per ~.

(To be continued.)

* The Electrical Review, July 30th and August 6th, 1915.

† If the centre holes per "cable code" letter be taken as = 3·7, as formerly was done, the corresponding constant for Morse code will = 4·7. Considering, therefore, the present-day extension of ocean-cable Morse code, the now generally-adopted constant of 4 contact signals to the cable letter, would, after all, appear to be an excellent and practical compromise covering all likely requirements.—E.R.-B.

DETERMINATION OF EQUIVALENT RESISTANCE AND COPPER LOSSES IN A THREE-PHASE STATOR.

By A. Nash.

Although the method of determining the equivalent resistance and copper losses in a three-phase alternating-current stator connected either star or in mesh is fairly well known, the derivation is, even amongst fairly qualified electrical engineers, somewhat hazy, and the accompanying explanation

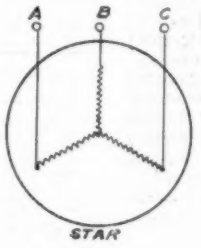

Fig. 1.

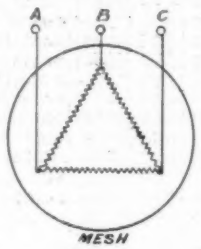

Fig. 2.

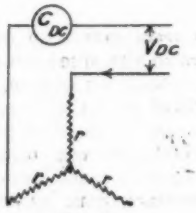

Fig. 3.

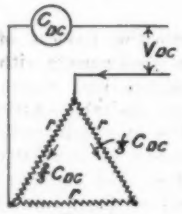

Fig. 4.

may be appreciated by electrical students, both on the test bed and in technical schools. In the following it is assumed that each phase winding has the same resistance.

Let *r* represent the resistance of one phase winding.
„ C_ϕ „ current flowing through one phase winding.
„ C_L „ line current per phase.
For star connection $C_\phi = C_L$
„ mesh „ $C_\phi = C \div \sqrt{3}$.

To obtain the value of r in ohms, apply a constant voltage with an ammeter in circuit to any two terminals AB, BC, or CA. This should be done whilst the machine is hot.

For a star connection $r = \frac{1}{2} v_{DC}/c_{DC}$.

This can easily be seen from fig. (3), as there are two phase windings in series.

Now, copper loss per phase $= c_\phi^2 r$.

In the three phases total copper loss $= 3 c_\phi^2 r$ ... (1)

Now, substitute $r = (\frac{1}{2} v_{DC}/c_{DC})$ in (1), and we get copper loss for a star connection

$$= 3/2 \cdot c^2 v_{DC}/c_{DC}$$

but $c_\phi = c_L$ for star connection.

$\therefore$ Copper loss $= 3/2 \cdot c_L^2 v_{DC}/c_{DC}$.

Mesh Connection.—Proceed in exactly the same manner, *i.e.*, apply a constant voltage to any two terminals. Fig. 4 shows plainly that the current divides up through two paths, one having resistance r and the other $2r$; consequently, two-thirds of the current will pass through the former, and from Ohm's law, voltage/current = resistance, the resistance r in ohms will be—

$$v_{DC}/\tfrac{2}{3} c_{DC} = 3 v_{DC}/2 c_{DC} \quad \text{... (2)}$$

Now copper loss per phase $= c_\phi^2 \times r$

and total copper loss $= 3 c_\phi^2 \times r$. (3)

Substituting value of r given in (2) in expression (3) we get—

Copper loss $= 3 c_\phi^2 \times 3 v_{DC}/2 c_{DC}$ ... ... (4)

but for mesh connection $c_\phi = c_L/\sqrt{3}$

and substituting in (4), we get—

$$\text{Total copper loss} = 3 (c_L/\sqrt{3})^2 \times \tfrac{3}{2} \cdot v_{DC}/c_{DC}$$
$$= 3 c_L^2/3 \times \tfrac{3}{2} \cdot v_{DC}/c_{DC}$$
$$= \tfrac{3}{2} \cdot c_L^2 v_{DC}/c_{DC}.$$

which is exactly similar to the star connection.

Summarising, all that is necessary to obtain the equivalent resistance for either a star or mesh connection is to apply a constant voltage with an ammeter in circuit to any two terminals of the machine, divide the voltage by the current, and multiply the result by $1\frac{1}{2}$. The total stator copper losses are then obtained by the product of this quantity and the square of the alternating current in the line for any particular load.

THE WORK OF THE ELECTRICITY COMMISSIONERS.

(Communicated.)

The electrical field is only one of those in which the optimism prevalent two years ago has proved to be misplaced. But perhaps in no other field did a rapid recovery then seem more feasible than in that of electricity supply. This arose largely from the fact that this subject had been investigated during the war by three separate committees connected with the industry, set up with different objects, and all of which had reported in much the same sense as regarded the supply part of the question. The establishment of the Electricity Commissioners would, it was hoped, clear the field, and by placing them under Sir Eric Geddes, at his own request, it was expected to obtain the necessary "push."

That the results to date are so disappointingly meagre and the actual achievements of the Commissioners so small, arises from several causes. These are not all the fault of the Commissioners, who were more or less bound by the Act to make some attempt to carry out a somewhat impracticable policy, before settling down to real constructive work. If perhaps they have taken rather longer than the electricity supply industry itself, to realise the real needs of the situation, it is not entirely their fault. The previous experience of the majority of the Commissioners naturally led them to attach more importance to forms of administration, composition of authorities, &c., and less importance than the business world does to the real question—the importance of getting some works started and the financial difficulties of so doing. Whatever the reason, the fact remains that to-day, two and a half years since the Armistice and longer still since the Board of Trade Report, not one important step has been actually taken towards building a "super station."

When the Commissioners were appointed some criticism arose in company circles that their sympathies would be too "municipal." The chairman, it was pointed out, had had comparatively little experience of private enterprise, Sir H. Haward had been a life-long municipal servant, and Mr. Booth always a Government official.

In practice, however, it cannot be fairly said that the Commissioners, in such decisions as they have made, have shown any pronounced bias. Their postponement of the County of London project until the L.C.C. and other parties interested had had a final chance to agree upon a scheme was at least well intended. If it be said that at Nottingham they seemed a little inclined to one side, yet at Chester they have approved the other.

Where a municipal or joint authority is really certain to proceed at once, so much the better. But if private enterprise offers the best chance of an early start, let us by all means use it, only provided we get the big station erected.

The attitude of the public towards the company and municipality question began to change ten years ago, and has changed very rapidly since 1915. In former days the question was who was to be allowed the profitable right to sell electricity in any given area. Now it is a question of who, if anybody, can and will find the money to put up big stations to enable the existing supply undertakings to reduce their expenses. Ten years ago, most municipal authorities, broadly speaking, favoured extending municipal responsibilities. To day, while there are plenty of optimists on municipal Electricity Committees, they do not get the same support from their Finance Committees and Councils as formerly, as regards expansion; and there is no superabundance of private capital for this purpose.

The first duty of the Commissioners—and the second—is to get some of these big stations started. This is what they were largely appointed to do, and expected by the public to do. The form of control and questions of administrative machinery, while by no means negligible, are of tertiary importance, and the decision will usually be facilitated, if not inevitable, if only the main purpose—real progress—be kept to the front.

It has been said that the Commissioners are inclined to attach rather more importance to the question of forms of control than does the general public, and have not fully grasped the change in public opinion, which is now most concerned with getting cheaper electricity. Even if the Commissioners had been able to get half a dozen joint authorities established, we doubt whether it would have had as much real effect on the industry as the erection of one super-station. As it is, the difficulties in the way of joint authorities—difficulties of sharing financial responsibilities, &c., apart altogether from difficulties of agreeing to form an authority—make it impracticable to delay helping the industry till they are in being. The industry looks to the chairman, as a practical engineer, to keep this fact before his colleagues.

This natural desire of the Commissioners, to establish joint authorities, if it can possibly be done, has guided their policy as regards the London situation.

They have given the London authorities every chance and encouragement to produce an agreed scheme. If no such scheme is forthcoming, and the experience of the past 15 years indicates the unlikelihood, the London authorities can certainly not complain that the Commissioners have not given them an opportunity.

It is in the interests of London as a whole, and in our opinion, of the supply authorities themselves, that an agreed scheme should be arrived at. But it must be a really workable scheme with a definite assurance that it will proceed, and not a half-hearted affair, intended, or at any rate subsequently used, merely to block a really big advance. The Commissioners may

be trusted to prevent this, and not to authorise a mere "paper" scheme, or even an agreed technical scheme, unless they are at the same time really convinced that the necessary administrative machinery is also ready and the necessary finance and honest determination to proceed is also present. If the next inquiry does not result in at least one super-station being really begun by one group or the other, public opinion will, indeed, begin to question the powers of the Commission. Incidentally, we believe that the starting of one up-to-date super-station in London, whether municipal or company, will do much more to bring about future agreement than the establishment to-day of an unwieldy Joint Authority without real unity of purpose.

ENGINEERING IN RUSSIA.

At the informal meeting of the Institution of Electrical Engineers on April 25th, Mr. J. F. Avila was in the chair, during the discussion, opened by Mr. C. L. Lipman, on "Engineering in Russia." The meeting was not as well attended as usual, and was the last of the session. The meetings will be resumed at the end of October. The chairman appealed for early notification of the subjects of papers offered for next session.

Mr. Lipman commenced by stating that for the time being the Soviet Government was the only possible Government capable of maintaining public order. The roots of Bolshevism had gone so deep that to extirpate the system hurriedly would only increase the industrial chaos. Now the Soviets had been able to turn from preparations for war, internal and external, to ambitious schemes for the mobilisation of town and village in the peaceful re-establishment of industry, and the engineering industry in particular.

A body called the Eighth All-Russian Congress of Soviets had planned this reconstruction. This Congress decided to start with the electrification of the most important industrial regions and, first, the coal mining and metallurgical industry of the Siberian, Ural, Moscow, and Donetz regions. It was anticipated that during 1921 the Donetz Basin alone would yield eight million tons of coal and 360,000 tons of pig iron.

The general destitution and the dearth of engineering materials had not permitted progress much beyond the excavating and lay-out stage, but considerable pioneer work had resulted. A hydro-electric scheme, the Kashir generating station, to supply Moscow and a number of adjacent counties was being rushed forward day and night, for it was decreed that all factories in Moscow should use electric power.

A temporary district station on the Shatour Marshes was helping the Bogorodsky transmission station to illuminate Moscow. The electric station at Sudakovsk works had been restored, and the works at Tula were receiving the required power. Seven industrial districts of the Moscow Basin were shortly to receive electricity from the Shatour and other stations with the object of obtaining 1,000,000 tons of coal per annum.

In the Petrograd district electrification was being carried out at a quickened pace; the Ontkin works were being reconstructed, and a new station had been commenced on the Viazen Marshes. On the river Svir (the Svir Volkhov station) a huge hydro-electric plant was in hand for the supply of the northern districts of the capital. Simultaneously dredging of the Svir was going on under the Mariinsky waterway project of connecting the Volga with the Baltic.

In the Donetz Basin the electricity works, reduced to a deplorable state in the fighting with Denikin, were already recovering, and at the end of February last 30 stations with a total capacity of 190,000 kW were working in three of the chief districts, while 3,000 motors of 122,240 h.p. had been repaired and put to use.

In the Kizelovsk coal district in the Ural great efforts were being made to finish the electricity works by 18 months hence. Nor was it only industrially that the electrification was going on. Thousands of cottages were receiving light, and in the Kieff district the workers' quarters were lighted free of charge.

Mr. Avila, in opening the discussion, admired Mr. Lipman's optimism in looking to a Russia stirring with electric transmission and transport while we in England had such difficulties with a dense population to justify the operations.

Mr. H. E. Crowcroft, who had spent some years in Russia, told of the German hold in pre-war days on the Russian engineering trade, especially in the Baltic Provinces, where the business correspondence was often conducted in German, and the rules and specifications were simply translations from German. He asked when might traders interest themselves in Russia, and what were the credit arrangements that the Soviet Government offered?

Mr. F. Pooley pointed out that all were concerned in the enormous demands for engineering goods that would result when a reliable Government could put Russia's materials into circulation. His transactions with Russian engineers had led him to think that their specifications were designed to hamper the English maker for the benefit of the German.

Major R. Grierson asked if there were now electricity Acts equivalent to our authorisations to supply, and any considered scheme for linking-up. He also wondered if after the Russian had done years of excavating with, say, two years more in which to erect and complete his stations, and had finally to light the areas free, he would show a profit by Bolshevist finance. He thought it desirable to get young Russians into English works, in order that they might return home with the correct bias.

Mr. Crowcroft, speaking a second time, said he did not think there was such an entire dearth of skilled labour in Russia as was held; he had seen thoroughly sound jobs carried out entirely by Russians. The Russian engineer was often extremely well trained, but frequently was too theoretical. There were no facilities at home for study, and he generally went to Germany, hence his bias towards German methods and standards. Still, he was convinced that our first-class materials would yet find a market in Russia.

Mr. Lipman, in reply, said that Germany by her proximity had received most students, and had naturally benefited. Further, the German was more complacent, and was ready to give long credits, but he did not believe the German influence would hold in the future. The trading agreement with Russia had been signed, and he appealed for sympathy with the only possible Government *pro tem*. He believed that things would right themselves, and that the Russian eventually would honestly meet all his obligations.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electricity Supply without Statutory Powers.

I am one of those supplying electricity with no statutory powers, and I should be very pleased to help or receive help or suggestions from anybody else supplying with no powers. I think if we could communicate with one another it would be to our mutual benefit. I have over six miles of overhead wires, supplying about 50 consumers.

Francis H. Grace.

West Sheen,
Thornbury, Glos.
April 28th, 1921.

Charging for Idle Current.

I read with much interest Mr. Carrothers's article in your issue No. 2,262 on a method of charging for idle current. In a letter published in your issue No. 2,265, written by Prof. Kapp, reference is made to the necessity for not only penalising a consumer for running with bad power factor, but giving a bonus when the power factor is leading. Although doubtless the number of cases of consumers running with leading power factor is comparatively few, a bonus for leading power factor is unquestionably desirable, and I shall be interested to know how Prof. Kapp would propose to arrange the sine meter which may run either forwards or backwards, so that a record is given in either direction. I take it that this would be possible with some sort of ratchet mechanism, such as is used when supplies may be given in either direction, as between two undertakings which are linked together. It seems to me that the underlying principle referred to by Prof. Kapp, viz., to charge on the basis of integrations of the meter, is not sound, as it will be obvious that at times of comparatively light load and poor power factor the sine meter will integrate a much heavier percentage, although the maximum demand is by no means as great as it would be at times of maximum load. I have always maintained that the only sound basis of charge is that of kVA demand, and am still of the opinion that the tariff should incorporate a charge based on kVA demand and a running charge per unit.

A sine and cosine meter fitted with the Merz maximum-demand attachment would give the desired result quite satisfactorily, as by simple trigonometry the actual demand in kVA can be derived from the readings of the two demand indicators, and the units integrated on the cosine meter would, of course, be charged for in the usual way.

If I read Prof. Kapp's letter aright, the supply bill would be increased or decreased from a datum line of 80 per cent. lagging, directly in proportion to the power factor, but, as is well known, this is not by any means proportional to the cost of the supply of electrical energy.

Taking as an example a 400-kW load at 80 per cent. power factor, viz., 500 kVA, we will assume the charge for this would be 1d. per unit. If the demand of 500 kVA remains the same but the power factor drops to 50 per cent., *i.e.*, 250 kW, under Prof. Kapp's proposal the charge for energy would be increased in the ratio of 8 : 5, viz., 60 per cent., *i.e.*, the charge per unit would be 1.6d. If this case be analysed it

will be seen that the demand on the supply company remains the same, viz., 500 kVA, and I shall be glad to know what justification there would be on the part of the supply authority for increasing the charge from 1d. to 1.6d. per unit.

With a 2-part charge, which I have always maintained to be sound in principle, the kVA demand charge in either of the two examples quoted above would remain the same, and the bill would only alter in proportion to the total number of units consumed, which is perfectly sound and logical.

As there is a difference of 60 per cent. in the two methods I shall be glad to have a little further information from Prof. Kapp to show how his method of charging would be justified.

E. W. Dorey.

London.
May 2nd, 1921.

The Training of Kinema Operators.

With regard to Mr. L. H. Edwards's letter in this week's Review on the above subject, the name of the trade journal running these tests is the *Bioscope*, 85, Shaftesbury Avenue, W.1; the course is conducted by "Crater," the technical editor.

I quite understand Mr. Edwards's experience in being unable to get a really good book on operating; the best two English books on the subject are at present out of print.

A lot of the trouble as regards learning operating is this: Some of the operators are not proficient enough to teach anyone, while others think that if you are taught the business thoroughly, thereby making you a proficient operator, you will do them out of their job. A lot of this sort of work has been done—yes, and worse; it came to this (it is a bit better now): If you could turn a handle, and carry a box of films, and work for a pound a week, you could have the job. Hence the duds you run up against. Every trade has its duds; I have met them in the electrical trade, and it is a great pity, for it is hard to improve them, and to show them what a great drawback they are to industrial progress.

Electrician Operator.

Bolton.
May 1st, 1921.

Transformers and Changed Frequency.

Amongst a group of electrical meter engineers, a somewhat curious problem recently "cropped up," and with the intention of seeing the views of others upon the subject, we are submitting it to the readers of the Electrical Review.

It is well known that in an alternating-current system, an increase or decrease in the rate of change of flux tends respectively to increase or decrease the voltage of that system. We also know that the converting properties of a transformer are directly controlled by the ratio of the numbers of turns of wire wound on that transformer.

From this it appears that a transformer wound for 25-cycle service would operate differently when used on a 50-cycle system—the ratio of the turns, however, decrees that it should operate just the same.

It is almost as complex as the old problem—"when an irresistible force comes into contact with an immovable body, &c. Can any reader explain?

Kilowatts.

May 2nd, 1921.

[The "problem" is really quite simple. When an alternating e.m.f. is applied to a coil, the current which flows produces a magnetic flux which cuts the turns of wire and generates a back pressure nearly equal to the applied pressure. Other conditions remaining the same, the back e.m.f. depends upon the product of the frequency and the magnetic flux (*i.e.*, the rate of change of flux). If the frequency is halved, the magnetic flux must be doubled to produce the same back e.m.f.—and, roughly speaking, that is what happens. As the secondary coil is cut by the same flux as the primary, the same reasoning applies to it; if the frequency is halved, the flux is doubled, and the voltage ratio remains practically unaltered.—Eds. Elec. Rev.]

Domestic Tariffs and Cheap Metering.

With reference to the interesting article under the above heading in your issue of the 22nd inst.

One advantage of the multi-part tariff system of charging lies in the ability, if desired, to allow for the meter rent in the fixed charge so that the consumer would on his account have two items only, the fixed charge and the single rate for the units consumed.

It is, of course, admitted that under a multi-part system metering accuracy is relatively less important in this connection; it was even pointed out in the early days of the rateable value and the telephone systems of charging that putting in one meter only for lighting, heating, and cooking meant putting in a comparatively large meter which might be slow on a very small lamp load—the answer to the objection was that in view of the system of charging any minor losses resulting from this would be unimportant.

Broadly speaking, however, it is permissible to doubt whether at the present time one should attempt to effect a small saving in the cost of meters by reducing their accuracy. For a long time past the old jest about the accuracy of the gas and electricity meter has died out, our own instruments are particularly accurate, and remain so over very long periods, and it seems a pity to destroy a reputation built up in this way, and also to take any action which might make it necessary to stock two brands of meter, one of the usual accuracy for supplies where the whole of the money is recovered as a charge per unit, and another of less accuracy where a multi-part tariff is in force.

J. W. Beauchamp,
Director and Secretary,
British Electrical Development Association, Inc.

London.
April 28th, 1921.

The Hackney Case.

Referring to an article in the "Legal" column of last week's Electrical Review *re* the Hackney Borough Council's refusal to connect the supply on account of the contractor not having a union ticket, I consider it out of all reason on the part of both Borough Council and the trade union, for in the first place I believe all electricity supply undertakings are bound by Act of Parliament to supply electricity wherever their mains are; in the second place, they supply the current to their clients, not to the contractors, who in the case of the Hackney Borough Council no doubt is a ratepayer, and therefore part and parcel of the concern; in the third place, what right has a trade union to force a master man into the union? They cannot find their unemployed work, and if a man starts in business for himself and does the work himself and finds the work himself, what right has any authority to demand money from a man in such a position? I call it almost highway robbery. Therefore I hope the Hackney Borough Council will lose the day, for if not it will mean the taking away of a man's living, for if he goes to join the union he may have to pay anything up to £25 to join. I should be pleased if you would publish this letter, and also to hear from anyone else on the matter.

E. J. Arnold.

London.
April 27th, 1921.

Nottingham's Electricity Supply.

Your contemporary, the *Electrical Times*, in its last issue, gives us the names of ten municipal undertakings (Stalybridge, Darlington, West Hartlepool, Sheffield, Bolton, St. Helens, Stockport, Bury, Leeds, and Coventry) which produce energy at less than one penny per unit, the average being 0.85d. In 1914 the average of the same undertakings was 0.52d., so that costs have increased by just about 50 per cent.

Now in my native city we have the wonderful record of 1.07d. in 1914 and 2.22d. in 1920, which is a very generous 100 per cent. rise. Here our most excellent engineer has reigned for over a quarter of a century, and during that time he has had the assistance of quite a large number of the most eminent electrical consultants of the day; we have hesitated to purchase even a kettle without the advice of perhaps two firms of consultants, albeit that our engineer has always merited and received the fullest confidence of his committee.

I am wondering what results Stalybridge would have been able to show to-day if only our excellent friend Mr. Blackmore had, during his term of office, called in, say, eight different consultants. Would Mr. Tough have transmogrified his undertaking as he has done if he had taken the advice of, say, six consultants?

We Nottingham folks are proud of our city, we are in all things consistent; our output of electricity per head of population in the year 1914 was 26 units, in 1920 the output was 34, whereas Wolverhampton sells 322 units per head, which, considering the present scarcity of coal, is scandalous.

Now, in Nottingham we probably have more private electricity plants to the square mile than any city in the country, so that our Corporation, when it has spent the prospective £2,000,000 on its new station, will always be able and justified in keeping the prices for electricity at the present comfortably high level.

Some few ratepayers here are foolish enough to ask for information as to the new station; the Corporation very rightly refuses even a printed copy of the latest consultant's report.

Now, Mr. Editor, on how many occasions during the past 25 years has your paper been used by the Nottingham Corporation for advertisements inviting tenders for machinery? We don't waste much cash in that silly way.

Veritas.

Nottingham.
April 30th, 1921.

The Transport of Coal by Suction.

Considerable attention has recently been drawn in the London Press to the coal suction plant now being installed at the City of London Electric Co.'s Bankside station. In all references it is stated to be novel, and in fairness to myself and other firms I consider it only right that attention should

be drawn to the fact that a coal suction plant has been in operation at the works of Messrs. Boots, the chemists, Nottingham, for the last four years.

The writer installed this plant to lift coal from barges into overhead bunkers a vertical distance of nearly 90 ft., primarily to prevent dust and dirt in these works, where cleanliness is absolutely insisted on.

This plant has been intensely successful, and a duplicate plant has since been installed, and plants are in hand in various parts of the country for the handling of coal, chemicals, ores, barks, and all classes of granular materials. Plants are also in hand for several Corporations, including Brighton and Bristol. The coaling of ships from floating plants is now being perfected, and will prove a great advancement on present methods.

Messrs. Pitman & Sons, recognising the importance of this departure, are publishing a small book written by me, entitled "Pneumatic Conveying," in which the principles and methods and constructional details are dealt with.

I have now been working for some time in conjunction with three important firms who are manufacturing and installing these plants, and in fairness to these good people it cannot be said that the Bankside plant is "novel."

E. G. Phillips.

Nottingham.
April 27th, 1921.

BUSINESS NOTES.

Bankruptcy Proceedings.—W. HEDGECOX, electrical engineer, Wolverhampton.—First meeting, May 7th; public examination, May 25th, both at Wolverhampton.

G. SUTCLIFFE, electrical engineer (G. Sutcliffe & Co.), Abertillery.—Application for discharge will be heard at the Town Hall, Tredegar, May 25th.

B. PORDES (United Electrical Manufacturers' Co.), 18-22, Christopher Street, E.C.—Last day for proofs for dividend, May 13th. Liquidator, Mr. E. Hawkins, 4, Charterhouse Square, E.C. 1.

S. BECKETT, Jun., electrician, 50, Deane Road, Bolton.—Receiving order made April 30th, on debtor's own petition.

A. J. HARRISON ("Xtra" Lighting Co.), electrical and gas engineer, 4, 5, and 6, Old Market, Sunderland.—Receiving order made April 29th on debtor's own petition.

H. DOYLE (Accessories Supply Co.), factor in electrical accessories, 56, Hardman Street, Deansgate, Manchester.—First meeting, May 11th; public examination, June 17th.

E. CLONEY, tramway divisional traffic superintendent, 5, St. Albans Road, Parliament Hill Fields, N.W.—Last day for proofs for dividend, May 20th. Trustee, Mr. W. P. Bowyer, Senior Official Receiver, Carey Street, W.C.

J. W. LAYTON, electrician, 5, Noble's Bank, Hendon, Sunderland.—Last day for proofs for dividend, May 18th. Trustee, Mr. W. A. Ellis, 3, Manor Place, Sunderland.

E. S. ELAM and J. WALTON, electricians, Kingston-upon-Hull—First and final dividend of 7s. 5d. in the £, payable May 10th, at the Official Receiver's Offices, Hull.

Company Liquidations.—STOFFELS ELECTRIC SWITCH CO., LTD.—Winding up voluntarily. Liquidator, Mr. S. R. Rogers 41, Eastcheap, E.C. 3. Meeting of creditors, May 9th.

COWPER-COLES ENGINEERING CO., LTD.—Meeting of members called for May 30th, at 11, Ironmonger Lane, E.C., to hear an account of the winding-up from the liquidator, Sir W. B. Peat.

ELECTROLYTIC CO. (SPAIN AND PORTUGAL), LTD.—A meeting of members is called for June 14th, at 5, Moorgate Street Buildings, E.C., to hear an account of the winding-up from the liquidator, Mr. R. I. Marsden.

AMPERE ELECTRICAL ENGINEERING AND PLATING CO., LTD.—Winding up voluntarily. Liquidator, Mr. T. L. Hammond. Meeting of creditors, May 11th.

TYNE ELECTRIC STEEL FOUNDRIES, LTD.—Winding up voluntarily. Liquidator, Mr. J. G. Swan, 31, Mosley Street, Newcastle-on-Tyne. Meeting of creditors, May 2nd.

HARMAN ELECTRIC CO., LTD.—A meeting of members is called for June 16th, at 9, Walbrook, E.C., to hear an account of the winding-up from the liquidator, Mr. F. M. Jeboult.

Inquiries.—Maker's name and address are asked for in respect of the "Ackerman-Johnson Anchor" for plugging slate switchboards, &c.

Dissolution of Partnership.—BALMFORD & SALT, manufacturers and wholesale factors to the electrical and allied industries, Electric House, Whittall Street, Birmingham.—The partnership between Walter Balmford and Francis Albert Salt has been dissolved. Debts will be attended to by Mr. Walter Balmford, who will continue the business in his own name.

Trade Announcements.—Messrs. W. H. Pease & Co., of Southampton Row, W.C. 1, have taken into partnership Mr. F. E. Pratten, formerly a director of Messrs. J. and E. Hall, Ltd., of Dartford. The name of the firm has been altered to W. H. PEASE, PRATTEN & CO.

MESSRS. PETTIGREW & MERRIMAN, LTD., have removed to 122 and 124, Tooley Street, S.E. 1; telephone, "Hop 134"; telegrams, "Merrigrew, Tooley, London."

THE MULLARD RADIO VALVE CO., LTD., have removed to 35A, Claybrook Road, Hammersmith, W. 6. Telephone number, "Hammersmith 312."

The Jackson Electric Stove Co., Ltd., have appointed MR. W. BLOGG, of the Sterling Telephone Co., of 8, Park Place, Cardiff, as their agent for the whole of Wales for their electrical cooking and heating apparatus. He will carry a stock at the address named.

The Midland Supply Co., of Birmingham, have appointed MESSRS. E. L. PRICE, of 34, Fenchurch Street, London, E.C. 3, as their representatives for London and district in connection with the Robinson electric lifting appliances.

THE E.M.F. WINDING CO., who have commenced business at 75-76, Wells Street, Oxford Street, London, W.C. 1, as specialists in the repair and rewinding of small motors, wish to receive catalogues and price-lists.

Owing to the growth of their business in Ireland, the SUN ELECTRICAL CO., LTD., have moved to larger premises, and opened new showrooms at Gibson's Building, Mill Street, Belfast, where a large stock of electric light fittings and material is available. The branch is under the management of Mr. E. P. Prior, as heretofore.

Catalogues and Lists.—MESSRS. CHIPPERFIELD, LTD., Oulton Broad, Lowestoft.—Four illustrated and priced leaflets—C/21, round pattern ignition coil; C/22, rectangular pattern ignition coils; S/23 and S/24, automatic battery cut-in and cut-out.

MR. A. B. CARTLAND, A.M.I.E.E., manufacturers' representative, 3, Creechurch Lane, Leadenhall Street, E.C. 3.—Two illustrated brochures on the "Zenith" patent furnace made by Wm. Whittaker, Burnley, and an illustrated description of the "Premier" Appliances, Ltd.'s system of boiler setting for reducing coal consumption.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., 20, Brazennose Street, Manchester.—Circular No. 1,426, giving illustrations and exhaustive descriptions of Metropolitan-Vickers turbo-alternators. Photographic reproductions of actual installations at Glasgow, Manchester, and Cardiff are given.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W. 1.—An illustrated and fully-detailed price-list of "Alden" oil engines and electric lighting plants made by the Alden Engine Co., Ltd.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C. 2.—Bulletin No. 10, "The Condenser System of Protection against Surges." This is a valuable pamphlet explaining the nature of high-voltage and high-frequency surges and their effects. Various methods of dealing with these surges are treated of, and, finally, a full description of the condenser method is given. Many illustrations of component parts of the apparatus and of actual installations are included in the publication.

THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, S.W. 8.—Leaflet H 29, illustrating and describing "E.A.C." float switches for a.c. and d.c. motors. Fully dimensioned and priced.

MESSRS. BERRY'S ELECTRIC, LTD., "The Switch House," 85, Newman Street, Oxford Street, W. 1.—A priced and illustrated pamphlet dealing with the "Midget Masta" fuse switch (*vide* ELECTRICAL REVIEW, April 22nd, 1921, p. 509).

MESSRS. HERBERT MORRIS, LTD., Loughborough, Leicestershire.—Book 90, giving illustrations, full details, and prices of worm-and-spur-gear pulley blocks, triple-gear pulley blocks, electric hoists, travelling trolleys, &c.

MESSRS. GEORGE ELLISON, Perry Bar, Birmingham.—Three lists giving exhaustive particulars, prices, and illustrations of switchgear, &c. No. 76 deals with oil-cooled rotor starters, No. 327 with totally-enclosed brake solenoids or power magnets, and No. 431 describes cable fittings, pipe flanges, sealing and dividing boxes, armour clamps, &c.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—An illustrated price-sheet of electrical accessories, including wall plugs, dry cells, reflectors, wire guards, fuses, Morse keys, switchgear, &c.

MESSRS. HIGGS BROS., Sand Pits, Birmingham.—"Monthly Magazine" (Vol. III, No. 3; May, 1921), giving details and prices of d.c. and a.c. motors, notes on insulation, and humorous items.

MESSRS. DAYSOHMS, LTD., 14-16, Cockspur Street, S.W. 1.—Bulletin No. 6, giving a number of illustrations and a description of the principles and working of the "Daysohms" low-pressure a.c. welder.

Wage Reductions in Sweden.—The dispute with the workers in the Finsoongs Metalverksaktiebolag (Metal Works), which resulted in a strike at the beginning of March on the question of wage reductions has now been settled. The terms agreed upon are a general reduction of 20 per cent. in piecework rates, and of 15 per cent. in time rates.—*Reuter's Trade Service* (Stockholm).

New French Company.—A new company has lately been formed in Paris (16, Rue de la Pepinière) with a capital of 10,000,000 fr. and the title La Société des Forces Motrices de la Vallée d'Aspe.

Book Notices.—"The Mining Electrical Engineer." Vol. I, No. 7, April, 1921. Price 1s. net.—Among the articles included in this issue of the journal are "Surface Electrical Equipment at Mines as affected by the Regulations of July 30th, 1920," by Mr. J. A. B. Horsley (H.M. Electrical Inspector of Mines); "The 'Kingsway' No. 2 Miners' Electric Hand Lamp," by Mr. A. E. Angold; "The Electrician and the Management," by Mr. W. Cairns, &c.

"Electro Annuaire de l'Electricité et Industries s'y rattachant," for 1921. Paris: 47, Boul' de Sébastopol. Price 12 fr., post free 14 fr.—This is a most comprehensive directory of the French electrical industry. The first part of the volume gives the names, addresses, and the nature of firms carrying on electrical businesses. The arrangement is alphabetically by *départements* and towns, Paris being given the first place. A classified section follows, this being split up under various heads, such as measuring instruments, cables, heating, &c. This is followed by a trade-mark section occupying several pages. The remainder of the volume is devoted to an alphabetical list of electricity supply stations; this list appears to give even the smallest undertakings. The nature of the motive power, type of current and voltages are given in most cases. Probably the advertisements, of which there is a large number, will also prove of use. A small booklet accompanying the volume gives the names and businesses of firms in Paris by *arrondissements* and thoroughfares.

"Reid's Handy Colliery Guide and Directory for the Counties of Northumberland, Durham, Yorkshire, Cumberland, and Westmoreland." Newcastle-on-Tyne: A. Reid & Co., Ltd. Price 3s. 6d. net.—This is a new issue of a very useful handbook to the colliery industry. The usual features have been retained and revised, including the 1911 Coal Mines Act, a map giving the position of collieries, and the railway systems of Northumberland, Durham and Yorkshire, regulations for the use of electricity in mines, lists of colliery owners and managers, &c.

"Practical Testing of Electrical Machines." By L. Oulton and N. J. Wilson. Pp. 258. London: Sir I. Pitman & Sons. Price 6s. net.

"The Electrical Transmission of Photographs." By M. J. Martin. Pp. xii + 136; 73 figs. London: Sir I. Pitman & Sons. Price 6s. net.

"Is Trade Unionism Sound?" By J. H. Bunting. Pp. x + 98. London: Benn Bros., Ltd. Price 6s. net.

"Kinema Operator's Handbook." By W. S. Ibbetson. Pp. 160, 37 figs. London: E. & F. N. Spon, Ltd. Price 4s. 6d. net.

"Lichttechnik." By Dr. W. Bertelsmann, and others. (591 pp. and figs.) Munich: R. Oldenbourg. Price M. 118 unbound and M. 126 bound.

"Dynamo and Motor Erection and Management." By A. Havery. (152 pp.; 91 figs.) London: Cassell & Co., Ltd. Price 1s. 6d. net.

Lead.—Messrs. James Forster & Co. report (April 30th):—"The general position is unchanged. Apart from the effect of the strike on the domestic trade, consumption is not good, and the electrical trade, although fairly well employed on old orders, is not booking anything ahead to speak of. On the other hand, supplies are decidedly short, and are the dominating feature. Only about 2,000 tons of soft pig-lead has arrived in the Thames this month in three steamers, all from Spain, and there is urgent want of ex ship lead of suitable brands, particularly for electrical work, consumers, of course, being averse to paying prices asked for wharf lead."

New Indian Company.—With reference to the statement appearing under this heading in our issue of March 11th, page 310, we learn from Mr. H. Nimmo, of Rangoon, Electrical Inspector to the Government of Burma, that the company called the Maymyo Electric Power Station Co., Ltd., was formed recently by a Belgian subject, but he understands that that company is now defunct. He adds: "No licence has yet been issued for the supply of energy in Maymyo, but there is every reason to believe that a licence for that purpose will shortly be granted to Messrs. Van Someren & Hamid, of Rangoon, whose application is now under consideration."

The King's Roll.—In the course of a recent speech, Dr. Macnamara announced that from the close of this month all firms tendering for Government contracts, to which the conditions of membership of the King's Roll were applicable, would, unless under exceptional circumstances, require to be on the roll or they would not get the contracts. "It is high time we laid down that condition, and I think everyone will agree it is an entirely reasonable one."

West Midlands Industrial Council Meeting.—The first annual meeting of the District Industrial Council for the West Midlands Area, which comprises the counties of Shropshire, Staffordshire, Warwickshire, and Worcestershire, was held in Birmingham, on April 30th. The meeting, which was preceded by a luncheon to celebrate a successful year's work, was attended by 40 members and delegates representative of the electricity undertakings of local authorities and companies within the area, and of the Trade Unions interested in the employés of such undertakings. Mr. R. A. Chattock (city electrical engineer of Birmingham), the Chairman of the Council, presided. Steps were taken for the election of members of the Council for the ensuing year. Votes of thanks, on the motion of the vice-chairman (Mr. Alderman Gregory), to the chairman for his services during the year, and to Mr. E. J. Jennings (Birmingham), the secretary and treasurer, terminated the proceedings.

The Coal Dispute.—Reports received from various parts of the country indicate the progress of the evil effects of the stoppage of coal production. Electricity undertakings are still carrying on, but supplies for the most part have been severely curtailed. The most drastic restrictions have been imposed at Accrington, where the electricity supply has been stopped entirely between the hours of 6 a.m. and 5 p.m., except on Saturday. The tramway service is also suspended after 10 p.m. On the other hand, Salford, owing to the prevalent trade depression, has found it unnecessary to restrict power supplies or go beyond the regulations regarding lighting issued by the Board of Trade. These regulations were published on April 25th, and direct that all public lighting shall be reduced by at least 50 per cent.

In Leicester many firms have had to shut down, and Wolverhampton has been severely affected, the iron and steel industry being practically at a standstill. Sunderland Corporation has been compelled to announce that manufacturers can only be supplied with electricity for three days a week, and the Newcastle Electric Supply Co. has also imposed many restrictions. Elsewhere on the Tyne, industry is gradually coming to a stop, although efforts are being made to keep as many men employed as possible. The Leeds Corporation is also unable to supply power for more than three days a week, except in very special cases. The Leeds tramway services, in common with those of most other towns, have been reduced considerably, and many routes have been suspended for a time. The Cambridge Electric Supply Co. now entirely suspends its supply for six hours a day. Owing to the low stocks of the Southend Corporation, all tram-drivers, conductors, and semi-skilled men (numbering about 200) were given a week's notice, which was to have expired on Wednesday last. Heavy "cuts" have been arranged in the London County Council tramway services, but so far it has not been found necessary to put them into operation.

The unemployment list continues to expand, and every day another thousand is added to it. Conferences between the owners and miners, with the Government standing between, have been unsuccessful, and reports from the various centres of the industry indicate that the miners are holding out, and are prepared to starve rather than give way an inch upon their terms.

Efforts to import coal from abroad have been unsuccessful in some cases, owing to the refusal of dockers and railwaymen to handle it, but it is reported that fairly large supplies have entered the country.

A Reuter message, dated May 2nd, stated that the French Government had authorised the export of coal to this country, and that a British firm desired to purchase 10,000 or 15,000 tons daily.

Swedish Electrical Preference.—The Swedish Electrical Industry Association is asking the Government to urge the municipalities when making purchases to give preference to Swedish goods.—*Reuter's Trade Service* (Stockholm).

Applications for British Trade-Marks.—Appended is a summary of the recent applications for British trade-marks in respect of goods and productions associated with the electrical trades and industries:—

Designs comprising a triangle and bars, Nos. 412,520 and 412,521, Class 13.—Electrical Appliances.—Hotpoint Electric Appliances Co., Ltd., 33, Cannon Street, London, E.C., February 15th, 1921.

Dictograph, No. 409,021, Class 8.—Telephone Instruments and Apparatus.—Dictograph Telephones, Ltd., Dictograph House, Denman Street, London, S.E., October 22nd, 1920.

Design, No. 404,243, Class 50.—Electric Insulating Preparations.—Koln-Rottweil Gesellschaft, 36, Dorotheenstrasse, Berlin, Germany, May 18th, 1920.

Acousticon, No. 409,022, Class 11.—Telephone Instruments and Apparatus for the Aid of Deaf Persons.—Dictograph Telephones, Ltd., Dictograph House, Denman Street, London, S.E., October 22nd, 1920.

Syncela, No. 410,334, Class 50.—Artificial Filaments, made wholly, or principally, of cellulose derivatives, electric insulating materials, &c.—British Cellulose and Chemical Manufacturing Co., Ltd., 8, Waterloo Place, London, S.W., December 2nd, 1920.

Celanese, No. 411,818, Class 50.—Artificial Filaments, made wholly, or principally, of cellulose derivatives, electric insulating materials, &c.—British Cellulose and Chemical Manufacturing Co., Ltd., 8, Waterloo Place, London, S.W., January 24th, 1921.

Fibrestos, No. 412,509, Class 50.—Sheets and Blocks of Cement and Asbestos, to be used as Electrical Insulators.—Siluminite Insulator Co., Ltd., The Green, Southall, Middlesex, February 15th, 1921.

Fiprallee, No. 412,289, Class 50.—Electrical Accessories made from asbestos.—Albert Lee & Co., Ltd., 8-9, New Zealand Avenue, London, E.C., February 8th, 1921.

Printing and Allied Trades Exhibition.—On Saturday, April 30th, Dr. Macnamara, Minister of Labour, formally opened the sixth International Printing, Stationery, and Allied Trades Exhibition, at the Agricultural Hall. Afterwards a luncheon was held, when the speakers included Mr. E. W. Humphries, President of the Master Printers of Great Britain and Ireland; Mr. G. H. Roberts, M.P., and Mr. C. W. Bowerman, M.P., President of the Printing and Kindred Trades' Federation. Former enemy countries have been excluded from the exhibition, but, in spite of this, it is larger than any of its predecessors. In our next issue we propose to give a description of some of the exhibits which, naturally, include a large amount of electrical apparatus. The show remains open until May 14th.

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High Wages and Industrial Depression.—Mr. W. L. Hichens, chairman of Cammell, Laird & Co., Ltd., in a statement issued a few days ago, says:—

"The question that is exercising the mind of everyone in the industrial world to-day is 'How are we to get back our trade?' How is the present depression to be overcome and unemployment to be banished? And there can only be one answer—by lowering prices. If we want to widen the field of those who purchase our goods it can only be done by selling cheaper. In fact if we wish to maintain our position as a great manufacturing nation we shall be obliged to cut down our prices. For in the world markets success comes, other things being equal, to those who can quote the lowest price, and it is idle to suppose that the world will buy from us if Germany or America or some other manufacturing nation offers to supply the same goods at a cheaper rate. It is well known that in the iron and steel industries German, Belgian, and American prices are very considerably below ours, whilst even our shipbuilding supremacy is threatened by German competition. For a short time possibly we may obtain orders in overseas markets owing to goodwill, but inevitably the time must come when our foreign clients will be obliged to buy in the cheapest market. Hence, it is essential that we should set our house in order and make up our minds to adjust our prices to those of our foreign competitors. This must be done in a number of ways; every form of economy must be exercised. The Government must set the example, and municipalities must follow suit, for the cost of Government and municipal taxation presses on industry with terrible weight, and is a severe handicap in world competition.

"Again, up-to-date and efficient machinery must be installed wherever it is lacking if we are to keep our heads above water, and economies of management must be carefully studied. Profits, too, must suffer, and in point of fact the ordinary shareholder is always the first to feel the pinch of bad times. Many firms at the present time are making quotations which include no profit at all, and often work is taken at a loss merely for the sake of keeping the place going and preventing unemployment.

"But however great the economies that are effected in these directions, they will not suffice to reduce our prices to a level with those of some of our foreign competitors. It is inevitable that there should also be a reduction in wages and salaries. Nobody wants to reduce wages; the higher they are the better, so long as the consumer is able and willing to pay the price. Everyone desires to see a civilised wage assured to all the workers in this country. But, if, after making every possible economy in other directions, British prices are still too high, then wages must either be reduced or cease altogether.

"In the iron and steel industry to-day German and Belgian prices for finished articles do not cover the bare cost of labour and material in this country, leaving nothing for overhead charges and profit. Nor would any reasonable reduction in the wages of the iron and steel industry alone suffice. There must be a big reduction in the price of all raw materials, in the price of pig iron and of coal. And this involves a reduction of wages in these trades, for wages are by far the biggest item in the costs of production. If it cannot be secured the iron and steel industry will lose its world market, and as a result will consume but little coal, so that large numbers of miners will be thrown out of employment, and instead of half a loaf will get no bread.

"The interests of all the big industries are closely related, and the misfortunes of one are bound to react on others. No industry can, in the long run, pursue a selfish policy without suffering for it. If, for example, the miners are strong enough to insist on keeping up the price of coal by maintaining high wages, they will ruin the other industries of the country, but they will also be dragged down themselves in the catastrophe. In their own interests, and in those of the community, the only sound course for the miners is to aim at supplying coal to the consuming public at the cheapest possible rates.

"The dominant factor in the industrial situation to-day is that our prices are too high in relation to those of our foreign competitors, and they can only be brought down to an effective level if every section of the community is prepared first of all to recognise the facts and then to bear its share in the sacrifices that are involved."

Electric Vehicle Licences.—Statements have recently been made to the effect that owners of electric commercial vehicles can claim to have their vehicles licensed under paragraph 6 of the Second Schedule to the Finance Act of 1920. Paragraph 6 referred to reads as follows:—"6. Any vehicles other than those charged with duty under the foregoing provisions of this schedule: Not exceeding 6 horse power or electrically propelled, £6; exceeding 6 horse power, £1 for each unit or part of a unit of horse power."

On such a statement it might be difficult for any owner of a commercial electric vehicle to convince the licensing authority that he was entitled to claim a licence under this paragraph for a commercial vehicle. This difficulty is now removed by a letter which Mr. F. Ayton, the honorary secretary of the Electric Vehicle Committee of Great Britain, has received from the Roads Department of the Ministry of Transport:—"I am directed by the Minister of Transport to state that a vehicle, whether electrically or otherwise propelled, weighing more than 8 cwt. unladen, which is constructed or adapted for use and used solely for the conveyance of goods in the course of trade, is chargeable with duty based on its unladen weight in accordance with paragraph 5 of the Second Schedule to the Finance Act. The Minister has, however, been advised that where a vehicle which is constructed and adapted for use for the conveyance of goods is used for other purposes, in addition to the conveyance of goods in the course of trade, the owner is entitled to obtain a licence under paragraph 6 of the Second Schedule to the Finance Act, 1920, as the vehicle is not used *solely* for the purposes mentioned in paragraph 5 of that schedule."

Accordingly owners of commercial electric vehicles, irrespective of the unladen weight, are advised, when applying for a licence, to make the application under A1 (B) of form R.F. (1) (they should decline to make it on form R.F.4 A) stating that they intend to use the vehicle or vehicles for other than solely trade purposes.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

LONDON.—June 3rd to 17th, Rubber Trades' Exhibition; July 4th to 15th, London Fair and Market; September 7th to 28th, Shipping, Engineering, and Machinery Exhibition; October, Society of Motor Manufacturers and Traders; November 17th to 25th, Public Works, Roads, and Transport Exhibition. 1923—British Empire Exhibition.

FOLKESTONE.—June 20th to 29th, Health Exhibition.

LEEDS.—July 21st, Yorkshire Agricultural Show.

MANCHESTER.—May 31st to June 11th, Efficiency Exhibition.

CARDIFF.—1922—Welsh National Exhibition.

BRITISH DOMINIONS.—June, 1921, Dominions Touring Exhibition (*South Africa, Canada, Australia, and New Zealand*).

FRANCE.—(*Bordeaux*) June 15th to 30th, International Samples Exhibition.

SWITZERLAND.—(*Basle*) May 28th to June 8th, International Automobile Exhibition.

HOLLAND.—(*Utrecht*) September 6th to 16th, International Industrial Fair.

ICELAND.—(*Reykjavik*) June, World's Fair.

PERU.—(*Lima*) June 1st to October 31st, International Industrial Exhibition.

ARGENTINA.—(*Buenos Ayres*), 1922, International Exhibition.

BRAZIL.—(*Rio de Janeiro*), 1922, International Centenary Exhibition.

MEXICO.—September, Commercial and Industrial Fair.

JAVA.—(*Bandoeng*) September 19th to October 9th, Netherlands East Indies Fair.

CZECHO-SLOVAKIA.—(*Prague*) May 28th to June 5th, Automobile Exhibition. (*Reichenberg*), August 13th to 21st, International Fair.

POLAND.—(*Warsaw*) May, Building and Fire Protection Exhibition. (*Posen*), May 28th to June 5th, Fair.

SWEDEN.—(*Gothenburg*), July 4th to 10th, Fair.

ITALY.—(*Padua*), June 1st to 15th, Samples Fair.

Spanish-American Electricity Co.—As may be remembered, a company was formed in Madrid last June under the title of the Compania Hispano-Americana de Electricidad to acquire the undertaking of the German Transmarine Electricity Co., of Berlin and Buenos Ayres, which was taken over as from January 1st, 1920. Although the accounts have not yet been published for the first year's activity of the new company, a Spanish newspaper devotes nearly three columns to recording the progress made by the great supply system in Buenos Ayres in 1920 and of the other supply and tramway systems in other parts of South America which also formerly constituted part of the German company's properties either directly or by shareholding. Statistics are given of the production and sales from the pre-war year of 1913 to the end of 1920, and it is shown that in the case of the Buenos Ayres works the consumption rose from 216,365,000 kW-hours in 1919 to 248,868,000 kW-hours last year, while the receipts advanced from 33,811,000 paper pesos to 36,910,000 paper pesos in the two years respectively. It is further mentioned that as a result of the fall in the prices of coal last year, the company entered into contracts for the delivery of 180,000 tons of coal and 100,000 tons of petroleum.

Parliamentary.—Last week a Select Committee of the House of Lords, under the chairmanship of the Marquis of Bristol, considered a Bill promoted by the County of London Electric Supply Co. to enable the company to erect a generating station at Barking, subject to the sanction of the Electricity Commissioners, and to raise the necessary capital for that purpose. The Bill was amended and ordered to be reported.

The Lochaber Water Power (Substitute) Bill was before a Committee of the House of Commons, Sir Harry Samuel presiding.

Brown-Boveri in Poland.—The Polish Electricity Works Co. (Brown-Boveri) is being formed at Warsaw by Brown, Boveri & Co., of Baden, and a Polish bank, to supply installation material made by the Swiss works. Manufacturing is also to be undertaken, and workshops for this purpose are reported to have already been acquired at Lemberg.

Patents, Designs, and Trade Marks.—The annual report of the Comptroller-General of Patents, Designs, and Trade Marks shows that the total number of applications filed during the year 1920 was 36,672, by far the largest number on record; the increase was largely due to the filing of applications from abroad under the Peace Treaties. Complete specifications numbered 21,796, an increase of 2,874 over the previous year. Applications communicated from abroad numbered 1,265, and applications under the International Convention for the Protection of Industrial Property numbered 6,797, compared with 2,661 in the previous year. Applications to register designs numbered 13,669, and there were 14,064 applications to register trade marks.

The receipts from fees for patents amounted to £420,472; for designs, £8,691; and for trade marks, £39,295, making, with other items, a total of £487,542, an increase of £83,067 over 1919.

Salaries amounted to £274,654, an increase of £72,119, due to the Civil Service war bonus. The receipts exceeded the expenditure by £86,507.

Electrical Wages: Agreed Reduction.—We learn that at a conference of the National Executives of the National Federated Electrical Association and the Electrical Trades Union, held at York on April 20th last, the two sides agreed jointly to recommend a reduction of 10 per cent. in the present rate of wages in two instalments—namely, 5 per cent. to come into force on the first pay day following May 9th for the pay period covered by that pay day, and a further 5 per cent. to come into effect on the first pay day following July 9th for the pay period covered by that pay day.

German Exports for East Africa.—The High Commissioner of Mozambique has telegraphed to the Portuguese Government that there is no objection to qualified German experts working for Portuguese companies in East Africa.—*Financial Times.*

Directors' Fees.—The point has arisen whether a director of a public company who has served in that capacity for less than a year is legally entitled to any remuneration for his services rendered during that time. In a case recently before the Courts, the plaintiff had acted as director of the defendant concern for about six months, when, owing to a dispute with his colleagues, he retired. He claimed the whole or part of his annual fee. The County Court Judge held that as he had not served for the full 12 months he was entitled to nothing. The Divisional Court has now reversed this decision, ruling that it was an implied term in the contract that a part of the plaintiff's salary was payable in proportion to his period of service. So far so good. The matter has a further interest for business men, however, because in the case of some companies, a certain sum is annually set aside as directors' fees, to be divided in such proportions among the parties as may be agreed. We are able to state that the Divisional Court's decision does not here apply, for the standing judgment is that under any arrangement for "bulk remuneration" no director is entitled to take anything out of the pool until he has completed a full year of office.

Coke for Steam Raising.—In a test made by the Gas Light & Coke Co., at Beckton Gas Works, to determine the best efficiency which could be obtained with a Lancashire boiler fired with large coke and fitted with "turbine" furnaces, made by the Turbine Furnace Co., Ltd., the draught produced by the chimney was 0.1 in. in the side flues, while the steam jets under the bars provided a pressure of 0.45 in.; the fuel was large coke, containing about 10.5 per cent. of ash. The test was carried on for six hours, during which 3,900 lb. of coke was consumed and 39,725 lb. of water evaporated. The average steam pressure was 77.6 lb. per sq. in., the feed temperature 50 deg. F., and the flue gas temperature 972 deg. F., the gases containing 18.3 per cent. of carbon dioxide. The fuel consumption worked out at 8.14 lb. of water per pound of coke, as fired, or at 9.8 lb. of water from and at 212 deg. F.

Cost of Living in China.—Writing in the *British Chamber of Commerce Journal*, Shanghai, for March, a correspondent says:—

"It should be clearly understood by engineers thinking of coming to China, that, the cost of living having risen to such a height, unless the allowances in addition to salary include housing, passages for the family both ways, allowance for increased cost of living (20 per cent.), hospital expenses, the admission to a pension or provident fund, and payment of salary (if in sterling) in 2s. dollars, the salary alone is quite inadequate for married people. All first-class foreign institutions give most, or all, the allowances named, and many of them a bonus as well, but the Chinese Government services allowances are in many cases inadequate and below the standard of the foreign firms."

Trade with Germany.—Mr. J. W. F. Thelwall, Commercial Secretary for Germany, will be working from May 2nd to May 14th in the Department of Overseas Trade, where he will be pleased to interview British firms interested in trade with Germany. Applications for such interviews should be addressed to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, S.W.1, and should bear the reference number F.W. 97281.

A French Amalgamation.—It is stated that a new company is to be formed to combine the Ateliers de Constructions Electriques du Nord et de l'Est (Jeumont) and the Forges et Ateliers de La Longueville.

The Electricity Supply Bill.—The Special Committee of the London County Council on London Electricity Supply recommends the passing of the following resolution:—"That the Council welcomes the introduction by H.M. Government of the Electricity (Supply) Bill, 1921, supplementary to the Electricity (Supply) Act passed in 1919, and urges upon the Government that in the public interest it should take every step in its power to ensure this measure becoming law during the present session of Parliament."

For Sale.—Burnley Corporation Electricity Department invites offers for one 250-kW triple-expansion Belliss-Dick, Kerr generating set, with condensing plant; also for one Lancashire boiler. See our advertisement pages to-day.

The B.E.A.M.A. New Members.—We are informed that the following firms have been recently elected members of the British Electrical and Allied Manufacturers' Association:—Babcock & Wilcox, Ltd.; Bonnella Bros; Clark, Robt., Ingham and Co., Ltd.; De la Rue, Thos., & Co., Ltd.; General Accessories Co., Ltd.; Power Plant Co., Ltd.; Sutcliffe (of Crumpsall), Ltd.; Venner Time Switches, Ltd.; Widdop Engine Co., Ltd.; Wilson, Hartnell & Co., Ltd.

Welsh Engineers' Wages.—It was officially announced at Swansea, last week, that, as a result of a ballot in the Welsh engineers' and founders' trades, the wages of fitters and moulders were to be reduced from £5 10s. to £5 per week, and labourers from £4 to £3 15s., on and from May 1st. The salaries of draughtsmen and clerks and the wages of firemen were to be reduced *pro rata* to the reduction on skilled workers' rates.—*The Times.*

Patent Restoration.—An order has been made restoring Letters Patent No. 2,045, of 1915, granted to J. P. Haworth, for "Improvements in electric accumulators."

LIGHTING AND POWER NOTES.

Accrington.—Supply from Blackburn.—Recently the Accrington Corporation, acting on the advice of the Electricity Commissioners, approached Blackburn for a bulk supply from the new station, in preference to extending the generating station at Accrington. The town clerk now reports that no offers or terms have come to hand, and he has been instructed to inform the Electricity Commission accordingly. Blackburn's contention is that the matter should not be pressed until the new station at Whitebirk is completed.

Aldershot.—Military Bulk Supply.—The Urban District Council has completed arrangements with the War Office for a supply of electricity in bulk from the Camp generating station. The estimated cost of the necessary feeders, converting machinery, switchboards, &c., is £18,000; the extension of the Council's own plant would cost about £25,000.

Aylesbury.—Inquiry.—On April 19th, Mr. M. K. North, Ministry of Health inspector, held an inquiry into the application of the Town Council to borrow £3,500 for the provision of electrical pumping plant at the sewage works, and also £1,144 for the laying of mains from the Council's power station to the works. It was explained that hitherto the works had been carried on by means of gas engines, but these were now worn out, and it was calculated that by the installation of electric motors a saving of £163 per annum could be effected.

Bath.—Loan.—The Electricity Committee has decided to apply to the Electricity Commissioners for sanction to borrow £30,000 for mains, &c.

Blackpool.—Increased Demand.—The electrical engineer states in his annual report that the withdrawal of restrictions on the purchase of materials for mains and service extensions has resulted in an abnormal number of applications for an electricity supply. The department has, for the first time, been compelled to institute a waiting list of consumers. The estimated profit on the year's working was £6,000, compared with £5,269 in the previous year. The units generated were 8,568,523, an increase of 1,379,369, equivalent to about 20 per cent. There was an increase of nearly 400,000 units for tramway purposes.

Bolton.—Effect of Trade Depression.—The Electricity Committee, on April 29th, considered a report from the electrical engineer making suggestions for counteracting the possible reduced demand for energy on the finances for the year ending March 31st next. Through trade depression there has been a considerable falling-off in the demand, and the engineer suggested that, in order to reduce expenditure, the extensions in progress at the Back-o'-th'-Bank works should be slowed down temporarily. This was agreed to.

Bridlington.—Price Increase.—At a meeting of the Electricity Committee the town clerk reported that the Minister of Transport had made an order authorising an increased charge for electricity not exceeding the sum of 11d. per unit, and also authorising the following minimum charges for electricity:—(*a*) In respect of each of the quarters ending March 31st and December 31st, for any amount up to 15 units, 13s. 9d.; (*b*) in respect of each of the quarters ending June 30th and September 30th

for any amount up to 10 units, 9s. 2d. The Committee considered the advisability of increasing the minimum charge for electricity, which at the present time is 7s. 6d. per quarter, and decided to defer the further consideration of the matter for the present.

Continental.—FINLAND.—The Finnish Diet has voted F.Mk. 10,500,000 for the preliminaries to the canalisation of the Imatra and Anjala Falls, with a view to the establishment of power-stations there.—*Economic Review.*

GERMANY.—Herr Hugo Stinnes has been asked to take in hand the project for water-power development in East Prussia. The waters which it is proposed to harness are those of the Masurian Lakes, which supply the Aller, upon which the necessary dams and works will be constructed.

PORTUGAL.—A commission has been appointed by the Portuguese Government to consider the advisability of establishing plant for the generation of electric power.—*Times Trade Supplement.*

Durham.—AGREEMENT WITH COMPANY.—The County Education Committee has concluded an agreement for a supply of electricity with the County of Durham E.P.D. Co. The terms of the agreement include the erection of a sub-station and purchase of plant by the Education Committee; the plant is to be installed by the company at a cost of £680. Special prices have been arranged.

Ealing.—LOAN SANCTIONED.—The Council has received the sanction of the Electricity Commissioners to a loan of £28,895, to be utilised as follows:—Mains (specific extensions), £12,500; mains and services (prospective expenditure), £8,000; total, £20,500; transformers (prospective expenditure), £2,500; meters (prospective expenditure), £3,500; expenditure prior to March 31st, 1920—mains, £1,350, and meters, £1,045. The Council's application was for £30,000.

Electricity Districts.—LONDON AND HOME COUNTIES.—The Electricity Commissioners have given notice that they will hold a local inquiry at the Institution of Electrical Engineers, Victoria Embankment, London, W.C., on Tuesday, June 14th, 1921, at 10.30 a.m. and the following days with reference to the area to be included in the proposed district and the objections and representations which have been made, and to consider schemes which have been submitted respectively by (*a*) The London County Council; (*b*) The Conference of Local Authorities Owning Electricity Undertakings in Greater London; (*c*) The London Electricity Joint Committee, 1920, Ltd.; [in each case for improving the existing supply of electricity, and for the formation of a Joint Electricity Authority]; (*d*) The Metropolitan Borough Council of Poplar [for improving the existing supply of electricity in "East London and District," and for the formation of a Joint Electricity Authority for such district]; (*e*) The Great Eastern Railway Co.; and (*f*) The London, Brighton and South Coast Railway Co. [in both cases for improving the existing supply of electricity]. Copies of the respective schemes may be obtained from the authorities concerned.

AIRE AND CALDER.—The Bradford Corporation has asked for a further postponement of the Leeds inquiry from May 18th, but the Electricity Commissioners, last week, refused it. There are, of course, possibilities of its further postponement if the miners' strike continues. It is expected that the inquiry might extend over 10 days, but efforts are to be made to bring it within a week if possible. Points of policy, rather than technicalities, are the main theme of dispute.

Glasgow.—MERCURY RECTIFIERS.—At a meeting of the Electricity Committee, relative to the acceptance of an offer by Messrs. Brown, Boveri & Co., Ltd., for the supply of mercury vapour rectifiers, which are being manufactured in Switzerland, the manager reported that considerable delay had taken place in the delivery of the rectifiers, and the Committee, after consideration, authorised him to visit the works of the contractors, with the view of ascertaining the cause of the delay and the progress which had been made with the manufacture of the rectifiers.

PROTECTION AGAINST FLOODS.—The engineer and manager of the Corporation electricity department proposes to install a floating boom or fender on the river Clyde, with the view of obviating trouble which has arisen in times of flooding on the river, when heavy floating *débris* chokes the circulating water inlet in connection with the new Dalmarnock works.

Great Harwood.—ELECTRICITY SUPPLY.—The Council on April 20th received a letter from the town clerk of Blackburn, stating that the electrical engineer had informed him it was difficult, under present circumstances, to fix a date on which electricity would be supplied to Great Harwood, but he might safely say the supply would be available in parts of Great Harwood for next winter.

Guisborough.—PROPOSED ELECTRICITY SUPPLY. — At a recent meeting of the Council a report on the question of the electric lighting of the town was referred to a meeting of the Council and representatives of the Cleveland and South Durham Electric Supply Co., Ltd.

Hawarden.—ELECTRICITY SUPPLY.—A special meeting of the District Council has been held to consider the question of electricity supply, and the report of Mr. J. W. Speight, M.I.E.E., A.M.I.Mech.E., on the proposed scheme for the supply of electricity to the district. The report stated that Mr. Speight had gone fully into the draft agreement with the Secretary of the War Office and the Joint Committee, and it was estimated that the capital expenditure required to obtain a supply from H.M. Factory at Queensferry would be roughly £50,300, to be divided amongst the various authorities according to their rateable values. The apportionment of the Hawarden Rural District Council would, therefore, be £12,490. According to the estimate of Mr. Britton (electrical engineer of Chester), the cost of generating at Queensferry was roughly 9d. per unit, and he understood that the Chester Corporation was prepared to give a supply of electricity to the Hawarden Council in bulk at a price, including all charges, of 6·26d. per unit. His estimate of the electricity required for light and power was 81,406 units. Mr. Speight was of opinion that the amount of capital the Council would have to subscribe if it were part of the Joint Committee, would be a serious obstacle to the undertaking at the commencement, but by arranging to take the supplies from Chester in bulk, it would not be burdened with a large capital expenditure in high-pressure transmission lines.

Haywards Heath.—ELECTRICITY SUPPLY.—Application has been made to the Electricity Commissioners by Mr. E. A. Bridge and others, for authority to generate and distribute electricity for public and private purposes within the urban districts of Haywards Heath and Cuckfield.

Hebden Bridge.—WATER-POWER SCHEME.—The generation of electricity by water power from the River Hebden, flowing through the woods of Hardcastle Crags and the Hebden Bridge Valley, is contemplated by Mr. John C. Mitchell, worsted manufacturer, Old Town Mills, for the driving of his machinery. He has taken the necessary initial steps.

Heysham.—ELECTRICITY CANVASS.—In response to an inquiry with regard to the North Lancashire and South Cumberland Electricity Supply District, the District Council has agreed to take a canvass of the district to obtain an estimate of the probable consumption of electricity in the area.

Leicester.—LOAN.—At a meeting of the Leicester Town Council, on Tuesday, a report submitted by the Tramways and Electricity Committee was adopted, deciding to make application to the Electricity Commissioners for sanction to borrow £723,000 for the first section of the new power station to be erected on the Freemen's Meadow. Ald. Flint, the chairman of the committee, explained that the Commissioners had sanctioned £450,000 on account, stating that before they could deal with the balance, details would be required of the various items of expenditure. The Committee, therefore, had decided to arrange for the installation of one 10,000-kW generator at the present time, instead of two as originally provided for.

London.—STEPNEY.—The Finance and Parliamentary Committee recently had under consideration a claim from a biscuit manufacturing firm in the district for a sum of £175, the value of five tons of biscuits which, it was alleged, were destroyed by a stoppage of electric power. The claim was repudiated.

Lowestoft.—LOAN.—The Town Council is applying for sanction to borrow the sum of £1,385, which represents the expenditure incurred in purchasing the assets of the Oulton Broad Electricity Co., acquired under the Provisional Order for the extension of the borough.

Morecambe.—PRICE INCREASE.—The Town Council last week approved a recommendation of the Electricity Committee that the price of electricity for lighting be increased from 8d. to 9d. per unit. A proposed increase from 4½d. to 5d. per unit for power was defeated. In the annual finance statement, last week, Alderman Jos. Snowdon said the street lighting department required £3,740 for the coming year, including £800 to be taken by the Gas Committee, and £1,330 by the Electricity Committee. The Electricity Committee estimated its deficiency at £2,124, including £1,650 special repairs to mains and batteries. The Electricity Committee was now having to pay 42s. per ton for coal, as against 8s. 6d. per ton before the war, and the wages bill had increased four-fold.

Preston.—REPORT ON ELECTRICITY SUPPLY.—Mr. J. A. Robertson, M.I.E.E., in a report to the Corporation on electricity supply, says that the capital necessary for development can be raised more quickly by the Corporation which will have direct representation on a joint authority. "The Corporation," he adds, "is in the fortunate position of having a site close to the borough, upon which a modern station could be erected capable of producing electricity at a minimum cost and sufficient for all future demands. The extent of Preston's requirements can be gauged by a reference to other towns with similar industrial conditions. In some towns the consumption of electricity per head of population exceeds 200 units; the averages of nine Lancashire towns depending chiefly on the cotton industry is 127 units per head. In Preston the average is only 22, this being about the lowest consumption of any industrial town in the country. Immediate steps should be taken to construct a new station on the site already acquired on the south side of the Ribble. Allowing a period of two years for construction, the station would be completed to meet the winter load of 1923-4. In the meantime the plant at Crown Street Station should be used to its fullest capacity. The new station would be designed to generate high-pressure three-phase current, which would be delivered by duplicate cables at 11,000-V pressure to Crown Street. The Ribble site is directly open to the coal-fields of South and East Lancashire and West Yorkshire. Coal should be conveyed by aerial transporters from the dock railway system, and deposited direct in overhead bunkers in the boiler-house. The estimated capital expenditure for the new works is £379,000."

Newark. — Proposed Extensions. — At a meeting of the Town Council on April 25th, it was proposed to postpone the scheme of extensions for a period of two years owing to opposition on the part of several large firms in the district. The proposal was eventually defeated, and it was resolved to apply for a provisional order for powers to carry out the extensions.

Rhymney. — Proposed Electricity Supply. — The Urban District Council has decided to consult Mr. Ellis, of Cardiff, on the question of securing a supply of electricity for the town.

York. — Hydro-Electric Scheme. — The York City Council has been informed that the Electricity Commissioners do not approve at the present time of the Corporation's proceeding further with the Stamford Bridge hydro-electric scheme.

The Grampian Schemes.—Settlement of Differences.—The *Scotsman* states that the differences between the Grampian Electricity Co. and the Lochaber Water Power Co. with regard to their respective schemes have been settled. The Grampian Co. has agreed to withdraw its application for the use of the Pattack waters in Laggan, thus leaving them free for the Lochaber scheme should it receive Parliamentary sanction. Upon this understanding the Lochaber Co. has also withdrawn its opposition, so that the two schemes are no longer competitive. The promoters of the Inverness-shire scheme have come to a friendly understanding with riparian proprietors and other individuals who lodged objections. The chief opposition that now remains is that of fishery and other interests on the lower reaches of the River Spey.

The Convener of Dundee Corporation Electricity Committee states that there is every possibility of the scheme being abandoned. The Corporation engineer had had some conversations with the syndicate during last week, and the culmination was a letter stating that they had decided to abandon the Bill for the session.

Wye (Kent).—Electricity Supply.—The Wye Lighting, Heating and Power Co, Ltd., is applying to the Electricity Commissioners for authority to provide and distribute electrical energy for lighting and heating for public and private purposes within a certain portion of the parish or township of Wye.

TRAMWAY AND RAILWAY NOTES.

Barrow-in-Furness. — New Depôt.—Operations have been commenced on the building of the new tramway depôt, giving work to a number of unemployed men in the task of excavation. The new depôt will provide a substantial enlargement of the present accommodation, and also mess and recreation-rooms for the tramway employés.

Electric Vehicles.—At a meeting of the Town Council, on May 2nd, the Health Committee reported the receipt of a letter from the Ministry of Health, stating that it was not prepared at the present time to sanction a loan for the purchase of four electric vehicles, but in view of the necessity for increased apparatus to carry house refuse to the new Cocken Bridge Tip, and in order to avoid any relaxation in the present refuse collection service, it had been decided to sanction a loan of £3,520 for the purchase of two vehicles, and the Minister would be prepared to issue sanction to a loan of £800 for the provision of charging plant on being furnished with a copy of a resolution of the Council, authorising application for sanction to borrow for that purpose. It was decided by the Council to approve a recommendation to defer consideration of the matter until the next meeting of the Health Committee.

Birmingham.—Electric Vehicles.—The Salvage and Stables Department of the Birmingham Corporation is making increasing use of electric vehicles for refuse collection. It reported this week to the City Council that deliveries under the contract with Edison's, Ltd., for 25 electric vehicles at £1,280 each had been completed. Three further vehicles had also been delivered for the sum of £1,804 each, and a fourth was to be purchased. The system of refuse collection had been wonderfully speeded up by the use of electric vehicles. The lighting of the depôt was effected by an existing generator. The amount paid to the electricity supply department for power was approximately £3,000 per annum, and it was estimated that there would be a total saving of approximately £2,000 per annum.

Bradford. — New Cars. — The Tramways Committee recommends the expenditure of £13,000 on the building of seven railless trolley-cars—six of a type to be driven and conducted by one man, and one experimental double-deck car with six wheels. It is proposed to build the cars at the Thornbury depôt of the Corporation, where the double-deck railless car at present in use was built, and from plans by the general manager. The advantages urged are economy in running cost and smoothness in travel. It is claimed that the one-man cars will save 4d. per mile. They will seat 30, one passenger more than the present single-deck railless cars, and they will have a smoking compartment. Mr. Wilkinson holds that the present cars are too frail for their work, and the new cars proposed will be much more substantial. The six-wheel experiment has been sanctioned by the Ministry of Transport, the contention being that the third axle will ensure smooth running and avoid wear and tear. The double-deck car is estimated to cost £2,200, as against £1,800 for each of the others.

Collision.—A collision occurred, last week, between a Corporation electric tramcar on the Lidget Green route and a steam wagon belonging to Messrs. Mercer & Co., haulage contractors. All the windows on one side of the lower saloon of the car were smashed, and the passengers were greatly alarmed, but there was no personal injury.

Tire Contract.—Despite repeated criticism, the Tramways Committee has decided to reaffirm its original decision to place with the Anglo-Belgian Improvements Corporation, the order for 100 steel tires. An error in tendering had been made, in respect of the class of steel, and critics contended that the Committee had not subsequently given English tenderers proper opportunity.

Chesterfield.—Time Extension.—The Minister of Transport has extended the time until July, 1922, of the Chesterfield Corporation Act, 1914, for the completion of the tramways and railless system.

Continental.—Spain.—In their report for last year, the Société des Tramways de Barcelona state that they are making preparations for various extensions and improvements in the electric tramways in Barcelona. In addition to extra rolling stock, much work requires to be done in connection with the track, especially at the crossings and points which were neglected during the war. The feeder system requires development, and in this connection three more 750-kW converters have been ordered for converting high-pressure alternating to continuous current. Already about 30 km. of new rails and a quantity of crossings and points have arrived in Barcelona.

Belgium.—The Labour demonstration of May 1st left Brussels without a tramway service, and motor-omnibuses were extensively employed. The company running the Antwerp cars pointed out to the employés that a cessation of work would constitute a breach of agreement, and it was decided, therefore, to run the cars on May 1st.

Edinburgh.—Tramway Electrification.—The Corporation Tramway Committee has agreed to the electrification of the Broughton route, in addition to the Liberton section of the tramways.

Guiseley.—Protest Against Fare Increase.—The Urban District Council last week decided to enter a formal protest against the Leeds tramway department's proposal to apply for powers to advance the statutory maximum fares from 1d. to 2d. per mile, and workmen's fares from ½d. to 1d. per mile.

Halifax.—Track Renewals.—The Tramways and Electricity Committee has recommended the relaying, &c., of certain portions of the tramway track on the Causeway Foot section at an estimated cost of £36,050, and the relaying of the track on the Pellon section at an estimated cost of £19,500.

Huddersfield.—Collision.—A Corporation tramcar and a heavily-loaded motor wagon collided in the Huddersfield Market Place on Friday night last, and the driver of the wagon, Charles H. Terry, of Bradford, had to be taken to the Infirmary with severe injuries. The driver of the tramcar and another man on the wagon were slightly hurt.

Hull.—Decorated Cars.—In an endeavour to beautify and brighten up the city, the Hull Corporation has put two gaily-painted tramcars into commission. Owing to their success it is intended to paint several more. The decorations consist of coats-of-arms and artistic designs.

London. — Traffic Co-ordination. — The London County Council is recommended by the Special Committee of Inquiry on Tramways to ask for the introduction by the Government of legislation to make provision for the unified operation of local passenger transport undertakings in Greater London, and for the setting up for such area of a municipal traffic control authority, to be appointed by the local authorities affected. The report points out that in Greater London there are some 122 road authorities exercising various powers of control. There are now being operated in this area about 17 systems of tramways and a large number of motor-omnibus undertakings, with numerous local railway systems in addition. The opinion is expressed that if the undertakings were worked in co-ordination, very great benefits could at once be secured for the public, while considerable financial advantages would accrue to the individual undertakings.—*Morning Post.*

Rawtenstall.—Loss in Working.—There was a loss of £1,746 on the tramways and £5,154 on electricity during the past year.

Sunderland.—Abolition of Workmen's Fares.—The Tramways Committee has received the sanction of the Ministry of Transport to the abolition of workmen's fares. Artisans, mechanics and labourers are now being charged the full fare when going to or returning from work.

Loan.—Permission is to be sought to borrow the necessary money for doubling the track from Spelter Works Road to the Grangetown terminus, to effect an improvement in the Barley Mow Bank, Ryhope Road, and to construct an additional entrance into the Wheatsheaf depôt *via* Dundas Street.

TELEGRAPH AND TELEPHONE NOTES.

Australia. — Imperial Wireless. — Mr. Wise, the Australian Postmaster-General, states that preliminary action was taken early this year for the selection of a site in Western Australia, on which to erect a wireless station in connection with the Imperial chain.

The Telephone Service.—Mr. Pike Pease (Assistant Postmaster-General), in reply to questions in the House of Commons, said that about 9,800 telephone subscribers had given notice to terminate their agreements during the four months ended March, 1921. As nearly as could be ascertained, about 3,000 of those notices were the result of the increased charges. The total number of telephones in service at December 31st, 1920, in the United Kingdom was 988,500, and in the United States approximately 13,500,000. The ratio of telephones to population was one telephone to every 47 inhabitants in the United Kingdom, and one to every eight inhabitants in the United States.

According to Sir W. Noble, engineer-in-chief to the Post Office, about £10,000 per annum is spent on telephone research work, but in America the telegraph and telephone companies spent £1,000,000 a year on such work. Automatic stations were working satisfactorily; at present they had 15 such stations established in which four different systems were working, and a fifth would be tried shortly. Of the four systems, one was less satisfactory than the others, and would not be used again. Up to the outbreak of the war the automatic system had not proved more economical than the manual system, but with the increase in operators' wages it would prove more economical.

"Bookmakers are apparently the only people who appreciate the facilities offered by the Post Office for letters to be dictated by telephone," said Mr. J. Scott, the Birmingham Postmaster, addressing the local Rotary Club recently.

Thirty words could be taken down at the head office, the Government providing the paper, and the caller only had to pay for the stamp.

United States.—Electrical Storm.—On March 5th, during an ordinary electrical storm, a violent electrical aerial discharge occurred at Kendalls, Wisconsin. It had the results and characteristics of an explosion of dynamite, but upon investigation it was found that it was entirely an electrical phenomenon, although it was not concentrated at any point, but was distributed over an appreciable area. The concussion was so severe that in nearly every business building window panes were shattered. Overhead wires, such as those of telephone, telegraph and power circuits, were mostly affected. The telegraph circuits along the Chicago and North-western right of way were all earthed through air gap protectors in the North-western station. The insulated copper earth wire between the protectors and the earth connections was fused, several holes were blown through the insulation, and the molten copper metal was completely blown out of the insulating covering. Isolated parts of the telephone equipment used for train dispatching were burned and destroyed. The bottom of the cable box at the open wire terminal, which is about 150 ft. from the station, was completely blown out, but otherwise box and equipment were uninjured. Practically all telephone circuits at Kendalls and in the immediate vicinity were out of service due to this storm. The relays controlling the crossing bells on the Chicago and North-western Railway were burned so that the bells rang continuously, which added more to the confusion. In the power house supplying the electrical energy for the city of Kendalls the switches on the power board were twisted into irregular shapes.—*T. and T. Age.*

Cable Landings. — Senator Kellog's Bill authorising the United States President to regulate the landings of submarine cables has passed the Senate. The measure now goes to the House of Representatives, says *The Times.*

United States Indo-China Wireless.—A commercial service was inaugurated, on May 1st, by the naval wireless system between the United States and Indo-China *via* Hawaii and the Philippines.—*Reuter's Trade Service* (Washington).

Wireless Telegraphy. — Elwell-Poulsen Arcs on Board Ship.—The Cunard Co. has installed Elwell-Poulsen arc equipments on some of its larger liners, and some very satisfactory results are being obtained. The first ship to be fitted was the *Caronia*, and the results of several trips which she has made are now available. On the Atlantic route, communication is maintained direct with the shore stations throughout the passage. Very good ranges are also obtained with the "Polar" spark equipment with which the *Caronia* is fitted in addition to the arc. At certain places on the route, however, spark jamming and atmospherics are particularly bad, and it is then that the arc is particularly valuable in getting messages through.

The s.s. *Caronia* has recently completed a cruise in the Mediterranean, and the operator reports that the greatest range obtained with the arc was with Bar Harbour, on February 25th, at 6.12 a.m., at a distance of about 2,423 miles, when continuous communication was maintained with New York.

Bar Harbour also received signals on February 22nd, at 9.30 p.m., while working to Devizes, this distance being about 3,500 miles, and while the s.s. *Caronia* was still in the Mediterranean. At 7.35 a.m. on February 25th communication was established with Norfolk, Va., at approximately 2,815 miles. Devizes was also communicated with on January 19th, at 6.50 a.m., at approximately 2,000 miles.

During the Mediterranean cruise, communication was kept up practically throughout with Devizes, despite bad jamming from spark and arc stations in the vicinity.

Although the main portions of the *Caronia's* arc equipment are those of a standard land station, there are several points of interest. A special method of keying is employed so that no spacing wave is radiated, and the power taken by the arc during the spacing period is considerably less than that during marking. Easy starting and a clear note are helped by the use of a separate alcohol vaporiser in the place of the usual drip-feed arrangement.

New Message Recorder.—The feat of recording autographically wireless signals from great distances has been accomplished by two Bureau of Standards physicists, at Washington, D.C.—Drs. B. A. Eckhardt and J. C. Karcher—who have demonstrated that their apparatus can pick up signals sent out from Lyons, France, 4,000 miles away, and automatically transform them into ink lines on a chart that can be read easily. They also have been able to place in the same circuit and record with the same pen the ticks of a chronometer and the Naval Observatory time signals that are sent out regularly by Annapolis.

The new device is hailed as the leading apparatus of the day from the standpoint of the astronomer, geographer, and surveyor. Scientists have been striving to invent it for the last 10 years. With it the longitude of any spot far away from cables and wires can be determined to within two-hundredths second of time or 35 ft., it is said. It was to fill that need of an autographic wireless time-recording apparatus to replace the present wire telegraphic ear-recorded methods of making scientific time observations that the Bureau of Standards began its work at the request of the Coast Geodetic Survey. Because of the relative simplicity and compactness of the apparatus and its ease of operation, it is expected it will find numerous commercial applications, especially in stations that cannot afford a highly-trained operator.

Briefly, the signal comes in and starts oscillations in a local circuit, which releases enough local steady current to operate a relay, which in turn through another local circuit operates the chronograph pen. The chronograph drum moves a sheet of paper past the pen at a uniform rate, and the signals are recorded as sums in the line, short humps for dots and long ones for dashes. By means of winding the actuating magnets in different directions, it is possible to record simultaneously with the same pen the seconds of local time as furnished by the local standard chronometer and compare them with standard wireless observatory time without the errors of "lag" of the instruments.

The chronographic recording drum used is that developed and in use by the Coast Geodetic Survey. A single electron tube operating at a low voltage furnished by a portable battery is sufficient to receive far-off Lyons, even when a poorly located temporary antennæ is used.

The new apparatus is compact and not highly complicated, and the Coast Survey will use it in its field work during the coming summer. Captain G. D. Cowie, of the Survey, is now working with Drs. Eckhardt and Karcher at the Bureau of Standards on the new field sets being made.—*T. & T. Age.*

Continental Service.—Mr. Pike Pease, during the Parliamentary debates, last week, stated that, under present conditions, the Anglo-Continental telegraph service is doubtfully remunerative. In the opinion of the Government it is not expedient to debar private wireless companies from conducting services with Continental countries, provided they are willing to submit to the conditions which the Government thinks it necessary to impose.

Wireless Interference.—Mr. F. King Vreeland, the well-known wireless telegraph engineer, is perfecting a device that it is stated will prevent interference in wireless signals. He is conducting his experiments at the Stephens Institute of Technology, Hoboken, N.J.—*T. and T. Age.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Argentina.—June 13th. The Department of Overseas Trade has been informed by telegram that the Department of Sanitary Works is calling for tenders for the supply and erection of electric power batteries and lighting plant at Mar del Plata. Local representation is essential. When a copy of the specification is received by the Department of Overseas Trade it will be made available for consultation.

Buenos Aires.—June 3rd. Board of Sanitary Works. Supply and erection of the plant and accessories for a new generating station, previous tenders having been called for in 1919 and 1920. The plant comprises three four-cycle Diesel engines of 375-h.p., and adapted to run on crude petroleum from Comodoro Rivadavia, and three three-phase alternators, each of 250-kW, 2,200 volts between phases, 50 cycles and a power factor of ·8.*

Port Authorities. Supply of 19 electric cranes.—*Reuter's Trade Service* (Buenos Ayres).

Australia.—MELBOURNE.—Postmaster-General's Department May 31st. Telephone switchboards (Schedule No 1,670.) 29,500 porous cells, No. 1 size to specification (Schedule No. 1,685); 20½ tons ammonium chloride (Schedule No. 1,683).*

June 15th. Victorian Government Railways. 50 oil-immersed single-phase track and signal transformers for power signalling (Contract No. 33,901).*

June 22nd. One electric lifting magnet (capacity ½ ton), one 440-V motor generator.

June 29th. Supply of 1-ton platform type industrial storage battery trucks, also battery-charging equipment.—*Reuter's Trade Service* (Melbourne).

August 10th. 250 core-type impedance bonds for power signalling, with a capacity of 1,000 amperes per rail; also 50 miles of solid insulated copper wire, No. 14 Brown & Sharpe gauge, and 50 miles of solid insulated copper wire, 16 standard gauge.

August 17th. 3,000 sets of renewals for caustic soda primary cells.—*Reuter's Trade Service* (Melbourne).

August 30th. Board of Works. Four electrical centrifugal pumps, each with a capacity of twelve million gallons daily.—*Reuter's Trade Service* (Melbourne).

PERTH.—May 25th. Postmaster-General's Department. Ironwork, as per Schedule 704. (April 22nd).

Belgium.—May 27th. The Service d'Etudes et de Controle des Applications de l'Electricité, 52, Boulevard du Regent, Brussels. For the supply and installation of ten electrically-operated capstans in connection with the locks on the Upper Scheldt.

BRUSSELS.—May 11th. Belgian Post and Telegraph authorities at La Salle de la Madeleine, Brussels. Supply of a quantity of telegraphic and telephonic apparatus, including 600 Morse manipulators and 250 milli-amperemeters.

Municipal authorities of Gistoux, Province of Brabant. Tenders for the establishment of an electric-lighting system in the town.

Edinburgh.—May 26th. Electricity Department. E.h.p. and l.p. switchgear for sub-station. (April 29th.)

Fiji Islands.—The municipality of Suva invites tenders, closing June 30th, for the supply and erection of a 200-kW, 480/520-V, three-wire, d.c. generator, directly coupled to a 300-h.p. vertical Diesel oil engine, together with accessories for generator and panel.—*Reuter's Trade Service* (Melbourne).

Glasgow.—May 31st. Electricity Department. Cables (including small i.r. cables and flexibles) and meters for twelve months. (See this issue.)

London.—PADDINGTON.—May 12th. G.W.R. Three months' supply of stores, including telegraph instruments and apparatus, electrical wire and cables, &c. (See this issue.)

L.C.C.—The Highways Committee is inviting tenders for feeder pillar earth panels and switch boxes required at sub-stations.

Manchester.—May 10th. Electricity Department. Weldless steel lamp columns. (See this issue.)

May 10th. Tramways Committee. Electrolytic copper and bronze trolley wire. Mr. J. M. McElroy, general manager, 55, Piccadilly.

Mexborough.—May 21st. Urban District Council. Electricity Department. One 750-kW rotary converter with transformer. (See this issue.)

Newcastle-on-Tyne.—May 17th. Electricity Supply Department. Half-a-mile single, l.p., lead-covered, steel-armoured main cable. (See this issue.)

New Zealand.—June 28th. Public Works Department. Ten s.p. oil-filled transformers for the conversion of three-phase current at 50 cycles, the voltage ratio being 50,000/11,000, for Waikato power scheme.*

June 28th. Supply and delivery at Lyttelton of two 50-kVA, two 100-kVA and two 200-kVA condensers in connection with the Lake Coleridge electric power supply (Section 116).*

Sale.—Urban District Council. Electricity Department. Converting plant, complete with e.h.p. and l.p., d.c. switchboards. (See this issue.)

South Africa.—Electrification of Capetown-Simonstown and Durban-Maritzburg lines. The date for the receipt of tenders has been extended to July 5th. (See this issue.)

Southampton.—May 14th. Electricity Department. 3-phase, 6,000-V cable. (See this issue.)

Uruguay.—June 28th. Ministry of Public Works. Three electric gantry cranes and a "Temperley" type aerial transporter for the Port of Paysandu. Tenders in Spanish and framed in accordance with the model to the Ministry of Public Works.*

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Barnstaple.—Town Council :—
Induced draught fan, £87.—Messrs. Bryant.

Birmingham.—Salvage and Stables Department. Accepted :—
Charging plant for electric vehicles, &c., £7,370.—Brightside Foundry and Engineering Co., Ltd.

Belgium.—The Belgian Post and Telegraph authorities in Brussels recently invited tenders for the establishment of a high-power post at the Government wireless telegraph station at Ruysselede. Four tenders were received, the lowest being that of the Federal Telegraph Co., San Francisco, U.S.A., which quoted $575,000, c.i.f. Antwerp.

Glasgow.—Corporation. Electricity Committee. Recommended :—
Switchboards for the Buchanan Street and Cadogan Street sub-stations, £7,444.—Messrs. Ferguson, Pailin, Ltd.

Leicester.—Town Council. Accepted :—
One 10,000-kW turbo-generator set, with condenser by W. H. Allen, Son, and Co., £91,394.—English Electric Co., Ltd.

Delivery within seven months is guaranteed. Ten British firms and three Swiss firms submitted tenders. The tender accepted was the lowest of the British. The highest was £102,169. The foreign quotations were lower than the English, but contained stipulations and refusal to submit to penalties for the non-fulfilment of the contract. The English Electric Co. has also prepared plans for the necessary buildings, and its tender for this part of the work amounts to £187,300. The company is also prepared to undertake to have the buildings erected and the plant running within twelve months of the date of the contract. The estimated cost of the boiler is £125,000.

London.—STEPNEY.—Electricity Supply Committee. Accepted :—
150/160 tons Northumberland D.C.B. slack, 28s. 1d. per ton.—Charrington Dale & Co.
One cargo Cowpen Northumberland ¾-in. to 1¼-in. nuts, 26s. 6d. ton
200 tons Welbeck 1-in. slack, 49s. 8d. per ton.—E. Foster & Co.
12 wagons New Hucknall ¾-in. main slack, 48s. ton.—C. Franklin.
12 wagons Selston Bright slack, 44s. ton.—Milner, Thomas & Co., Ltd.
Two barges New Hucknall ¾-in. low main slack, 47s. 1d.—A. Blackman & Son.
¼ mile "D" troughs and covers, £105.—Sutton & Co. (accepted).
6 miles "A" and "C" and 3½ miles "D" troughs and covers; 2½ miles 3 in., 4½ miles, 4 in., 3-way earthenware conduits—

Sutton & Co. (accepted)	**£11,921**
W. T. Henley's Telegraph Works Co.	12,466
Siemens Bros. & Co., Ltd.	12,670

One 6,600-V trifurcating box, £181.—A. Reyrolle & Co., Ltd. (accepted).
Repairs to electric van, £259.—Agricultural & General Engineers, Ltd. (accepted).

Manchester.—Electricity Committee. Accepted :—
Switchgear for 2,500-kW and 1,500-kW motor converters at Dickinson Street sub-station, battery booster, short circuiting switch.—Bertram Thomas.
Cables.—Pirelli-General Cable Works, Ltd., and W. T. Henley's Telegraph Works Co., Ltd.

Perth.—Accepted :—
Additional generating plant at Friarton Works, £15,000.—W. H. Allen, Son and Co., Ltd.

Salford.—Watch Committee. Accepted :—
Installation of electric light at the Chapel Street police station, £50.—Lincoln, Chambers & Co.

Education Committee.
Electric light installation, £261.—W. Smith & Co.

Electricity Committee.
Erection of transformer sub-stations at Weaste, £32); at Lower Kersa £388.—Moseley Construction Co., Ltd.

FORTHCOMING EVENTS.

Edinburgh Electrical Society.—Friday, May 6th. At the Philosophica Institute. At 8 p.m. Annual meeting.

Roentgen Society.—Friday, May 6th. At Manchester. Paper by Prof. W. J. Bragg, and a demonstration by Prof. A. V. Hill.

London Association of Foremen Engineers.—Saturday, May 7th. At the Cannon Street Hotel. Sixty-eighth anniversary festival.

Batti-Wallahs.—Monday, May 9th. Lunch at the Holborn Restaurant. At 1 p.m. Speaker, Canon H. Bickersteth Ottley.

Institution of Electrical Engineers.—
North-Eastern Centre.—Monday, May 9th. At the Armstrong College, Newcastle. At 7.15 p.m. Annual general meeting.
South-Midland Centre (Students' Section).—Tuesday, May 10th. At the Birmingham University. At 7.30 p.m. Annual general meeting.

Faraday Society.—Monday, May 9th. At Burlington House, Piccadilly, W. At 8 p.m. Ordinary meeting.

National Association of Supervising Electricians.—Tuesday, May 10th. At St. Bride's Institute, Bride Lane, E.C. At 7 p.m. Paper on "Electric Light Wiring Systems," by Mr. F. T. Alldread.

Institution of Railway Signal Engineers.—Wednesday, May 11th. At the Midland Grand Hotel, St. Pancras, N.W. At 5 p.m. Discussion on the Reports of the Sub-Committees on "Track Circuit Nomenclature" and "Track Circuit Record Forms."

Physical Society of London.—Friday, May 13th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

NOTES.

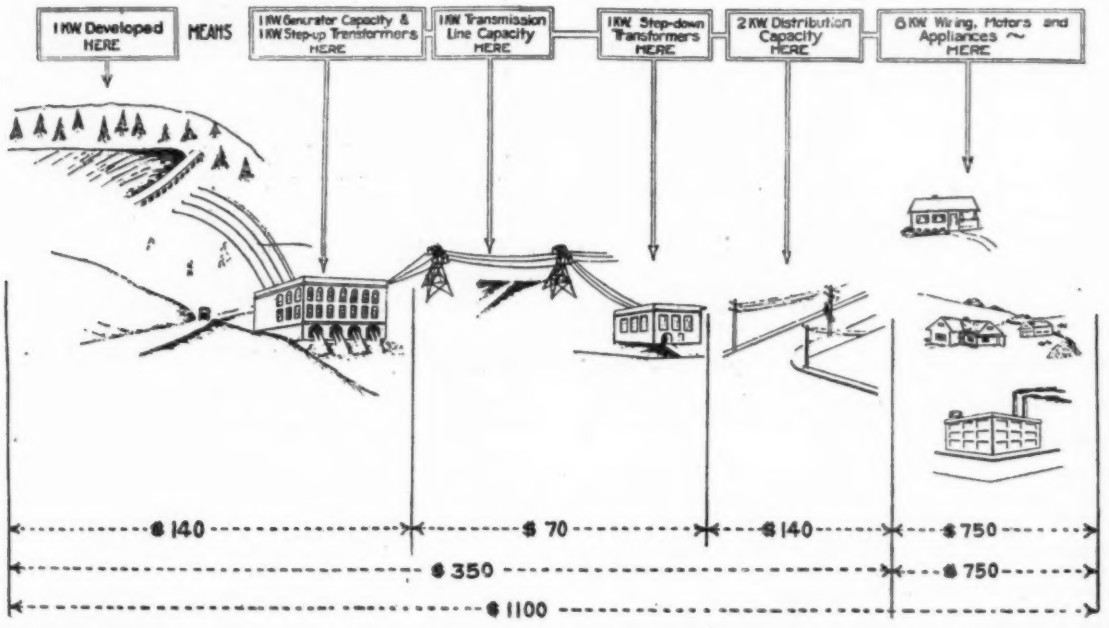
Birmingham Electrical Golfing Society.—The Spring meeting was held on the course of the Robin Hood Golf Club, on April 26th, under ideal conditions. The "Trade" Cup was won by T. P. Holder (4), 78, A. Pearson being second with (12) 79, and J. H. Harpin third with (12) 81. J. H. Berry won the sealed nine holes with (9) 41. There was a representative gathering, and the event was keenly enjoyed. It is proposed to hold the Summer meeting early in June.

Apprenticeship Association.—The fifteenth annual report of the Skilled Employment and Apprenticeship Association shows that during 1920, 355 boys and 214 girls were "placed" by the Association; 118 boys were apprenticed to the engineering and heavy-metal trades and 41 to instrument making. A total of 1,605 cases was dealt with during the year by the London Committees, and it is pleasing to note that the subscriptions and donations were increased by a special effort on the part of the Committees. In spite of this however, the Associaton finished the year with a deficit of £20.

What Hydro-Electric Development Means to Industry.—In the west of the United States, where industrial progress is dependent upon the development of hydro-electric energy, every effort is being made to demonstrate to the public the direct results of such development. An effective appeal to the layman has been formulated by Mr. J. M. Morris, of the Westinghouse Electric and Manufacturing Co., Los Angeles.

The basis of the appeal is four charts which have been prepared from actual data on present conditions by the Southern California Edison Co.

One of the charts shows the comparatively large sum of money that must be spent in utilising the energy as compared with the cost of generation, transmission, and distribution. This is shown as indicative of the huge sums that will be spent annually in the electrical industry in the West. We reproduce from the *Electrical World* this chart, which also bears the following statement:—



Estimated cost of future power development on Pacific Coast, $50,000,000-$70,000,000 per year.

On a basis of $50,000,000 per year this represents approximately 140,000 kW in generator capacity.

Represents $105,000,000 per year in wiring (including labour), motors, lamps, and appliances.

The other charts present different aspects of the argument, either graphically or verbally. Thus one states that "the kW in additional electric power, at a cost of $350, makes possible the building of one home, the irrigation of four acres, and the employment of one person in an industry, and means $6,000 to the community."

Appointment Vacant.—Electrical engineer and manager for the Abertillery Urban District Council. See our advertisement pages to-day.

Several vacancies for Junior Inspectors of Factories under the Home Office will be filled shortly at a salary of £200, rising by £15 a year to £350, and a war bonus. Candidates should send in applications before May 21st. Particulars may be obtained from the Private Secretary, Home Office, Whitehall, S.W. 1. Appointment is by competitive examination. The age limits are 23 to 30 years on August 1st, 1921, with a possible extension up to 35 years in case of men who have had 10 years' experience. Preference will be given to those who have served with H.M. Forces in the war.

London Traffic.—London Members of Parliament met on April 28th, with Mr. J. D. Gilbert in the chair, further to discuss the question of traffic congestion in the metropolis. As the result, a Sub-Committee was appointed to consider the suggestion of the Ministry of Transport that the London members should assist in framing proposals to deal with the problem. The Committee is to consist of Mr. Kennedy Jones, Mr. Gilbert, Viscount Curzon, Mr. Purchase, and Sir William Bull.—*The Times.*

The Attraction of Good Lighting.—To convert the wealthy corporation to a new principle or method of business, or, at any rate, to bring it to the stage of interest and experiment, is a relatively simple matter. In connection, for example, with the lighting of shop windows, little difficulty has been experienced in persuading the big department stores to install up-to-date systems. Small traders, however, have not been convinced so easily of the advantages of scientific design, and the majority of suburban shops pathetically exemplify the futility of pouring the new wine of gas-filled lamps into the old bottles of obsolete equipment.

Here and there one may see windows lighted adequately and artistically, and yet more rarely a small community of well-illuminated shops may be discovered. Such an aggregation is to be seen at Palmer's Green. Messrs. J. Prosper & Sons, the local electrical contractors, are lighting enthusiasts (this in itself is a very useful basis for successful propaganda), and they have the further merit of recognising that practice is far more efficacious than precept. By equipping their own shop window with concealed "X-ray" reflectors and "Mazda" gasfilled lamps, and thus distinguishing it from the windows on either side, the firm created a feeling of discontent among its neighbours to such excellent effect that within a few weeks 12 shops in the same block had installed "X-ray" equipment.

Educational.—At a meeting of the Swansea Electricity Committee a letter was read from Dr. T. Franklin Sibly, the Principal of the University College of Swansea, stating that they were seeking to secure for the engineering department of the College, the advantage of occasional courses by engineers of high professional standing in the district, and inquiring whether the Council would be prepared to allow the borough electrical engineer, Mr. J. W. Burr, to deliver an advanced course of special lectures in the College if invited to do so by the Council of the College. Mr. Burr had intimated his willingness to undertake the course on the understanding that no remuneration should be paid to him. The Committee, highly appreciating the honour paid to Mr. Burr, readily consented to his giving the course of lectures.

LEEDS.—Owing to the supply of wireless operators being understood to be in excess of the demand, the class for training such operators at the Leeds Central Technical School is to be closed.

ITALY.—In order to provide skilled staffs, it has been decided to found a Laboratorio-Scuola di Radiotrasmissioni in the Via Cappuccio, in Milan. The Government, local societies, and manufacturers have joined financial forces to realise the undertaking.

FINSBURY TECHNICAL COLLEGE.—The Governing Body of the Finsbury Technical College announces that the entrance examination for the Session 1921-22 will be held on Tuesday, September 20th next. Applications for admission should be forwarded to the College not later than September 15th on forms to be obtained from the Registrar, Leonard Street, City Road, E.C. The programme of the College is under revision, and will be issued in due course.

The Dangers of Radium.—Concerned by the dangers attending the application of radium, the French Academy of Medicine has appointed a committee to frame a list of measures of precaution. The decision followed the reading of a paper by Prof. Bordier, of Lyons University, who declared that the dangers incurred by those manipulating radium were far greater than those faced by X-ray operators. While the ravages of the X-rays are visible at an early stage on the hands, radium works insidiously on the marrow of the bones and on the spleen, the damage being unknown to the victim until one day he finds his health undermined by a pernicious anæmia, which may be fatal. Dr. Béclère, who for years has employed radium at the Saint Antoine Hospital, is rather optimistic. He thinks that if certain precautions already known are followed, the dangers become very slight. The salts of radium, he states, should not be touched by the hands, but by instruments. The wooden table at which the operator sits should have a leaf of lead to avert risk to the legs, for the radium rays pass easily through wood. The chest of the operator should also be protected by a shield of lead, and he should wear spectacles, which, though of clear glass, ought to contain salts of lead. In that way, says Dr. Béclère, only the hands are exposed, and those very slightly.—*Daily Telegraph.*

The Electrification of a Diamond-Cutting Factory.—The most important of the factories erected by Sir Bernard Oppenheimer, under his scheme for training ex-Service men in the diamond-cutting industry, is that at Brighton, where operations are carried out on a commercial basis, the men being enabled to earn a wage which, though not very large at first, soon compares favourably with that earned in other skilled trades.

The Brighton factory has been equipped throughout on most modern lines, and the buildings are so commodious, well-lighted, and clean, that the recovery of the men is undoubtedly accelerated by their surroundings.

The whole of the power required for driving the various sawing, cutting, and polishing machines is electric, the workshops containing in all 105 motors with the necessary control gear and each bay about 100 polishing units.

Both d.c. and a.c. power is brought in from the mains of the Brighton Corporation. The former is a 460-volt, 3-wire, supply for lighting, and the latter is 6,600 volt, 3-phase, transformed down to 400 volts, and distributed to the motor circuits by a switchboard.

The first step necessary on receipt of the uncut diamond is to mark it out; it is then sawn into suitable sizes, which is accomplished by means of saws driven from line shafts, two 10 h.p. squirrel cage motors running at 960 r.p.m., being required in the saw room. It is interesting to note that the saw blades used are of phosphor bronze, 3/1,000ths of an inch thick. They are trued up in centres, and on them is pressed diamond dust and olive oil so as to produce the required degree of cutting power. The saw-making sets are driven by 1/10 h.p. motors at 2,000 r.p.m., and there are 1,500 polishing units installed. The polishing bays are each equipped with six 7½-h.p. disks at a speed of 2,400 r.p.m. Each motor in these bays, as throughout the installation, is controlled by a special auto-transformer starter panel.

From the electrical point of view the chief interest lies in the extent to which the electric drive fits in with the main object kept in view in laying out the factory and its equipment—that is, the provision of simple, clean, and efficient methods of carrying out the various processes involved.

The lighting scheme, by a suitable combination of general and local units, enables a high degree of illumination to be concentrated upon any part of the work in hand.

The whole of the electrical equipment for both power and lighting was supplied and erected by the General Electric Co., Ltd.

Miners' Electric Cap Lamps.—The Miners' Lamps Committee, as a result of its investigation into the question of the safety and practicability of miners' electric cap lamps, has advised the Secretary for Mines that he should approve such lamps for general use in mines under the Coal Mines Act, subject to each type of lamp passing the necessary official tests as to its safety and mechanical soundness. The type of cap lamp made by Messrs. Oldham & Son, Ltd., Denton, near Manchester, having passed these tests and been put through a series of practical trials in coal pits extending over many months, has been approved by Order, dated April 20th, made under Section 33 of the Coal Mines Act, 1911. Applications for the approval of types of cap lamp of other makes are now being dealt with by the Mines Department. The Order of April 20th, which is now in the press, and will be published shortly, also approves the following new types of miners' electric hand lamps:—

Pearson Ni + Fe lamp, made by the Alkaline Miners' Lamps, Ltd., Stratford.

Patterson type G-1 lamp, made by Messrs. Patterson & Co., Newcastle-on-Tyne.

The Federation lamp, made by the Federation Lamp Co., Sheffield.

The Adams lamp, made by Messrs. Adam Bros. (Longton), Ltd., of Longton, Staffs.

Wanted—A Motor.—The engineer-in-chief and manager of the Shanghai Municipal Council Electricity Department (Mr. T. H. U. Aldridge, M.I.E.E.), has sent us the following letter received from a Chinese client, which indicates that the virtues of the electric motor are being fully appreciated in Shanghai:—"Due to the fact that we are fail to make profit by using a engine, which by its slowness in work, expensive in charges and also dirty and noisy. The engine we are now using is 12 h.p. Having learned that an electric motor is a hasty and energetic worker, it works quietly, expends economically, locates only a small space, and is easy to operate. By the above several goodness we would like to make a change, and it might satisfy us when taking into use. Hope you will send us one for our benefit at your earliest convenience."

Deputy Wardenship of the Standards.—The President of the Board of Trade, by arrangement with the Lord President of the Council, has appointed Mr. J. E. Sears, junr., C.B.E., M.A., A.M.Inst.C.E., F.Inst.P., to be Deputy Warden of the Standards in succession to Major P. A. MacMahon, F.R.S., who has retired under the age limit. Mr. Sears is Superintendent of the Meteorology Department at the National Physical Laboratory, under the Department of Scientific and Industrial Research, and will continue to hold that post in addition to that at the Standards Department of the Board of Trade.

The Kelvin Medal.—In the presence of a large gathering of representatives of all branches of science and engineering, Dr. W. C. Unwin, F.R.S., was presented with the first Kelvin Medal on May 4th. The chairman of the Award Committee (Mr. J. A. Brodie), in a brief speech, introduced Mr. A. J. Balfour, O.M., F.R.S., who made the presentation.

Mr. Balfour, in his speech, said that not only was the medal a form of recognition of the merits of the living, it formed a fitting memorial to the great Lord Kelvin. He had been one of Kelvin's personal friends, and had happy recollections of the kindness and courtesy he showed to all with whom he came into contact. Kelvin was essentially a mathematical physicist, but he was also pre-eminent as an engineer, and was perhaps the greatest man of his kind since Archimedes. The combination of theory and practice which he made it his duty to encourage has had its results in the progress seen by the present generation. The speaker, however, desired to do honour also to Dr. Unwin. Wherever there were engineers, Dr. Unwin's name was honoured, and his fame was world-wide. His work had long guided the young engineer in his studies. Probably his name was not widely known among the general public, but among those who mattered he was more than well known. His text-books formed the foundation of the study of many branches of engineering, and these alone would justify the committee's choice. In presenting the Kelvin Medal to Dr. Unwin he (Mr. Balfour) was voicing the unanimous verdict of the whole of the scientific world.

Dr. Unwin (who found it difficult to speak for a few moments) said that it added to the great honour conferred upon him to receive the medal from the hands of Mr. Balfour. What he was able to accomplish was due in no small measure to able and loyal assistance. He was a teacher, and it pleased him to see how facilities for young engineers had grown in this country, although we were still behind France and Germany. Dr. Unwin recalled the scientists of his early days, when Joule was determining the mechanical equivalent of heat, and Bessemer was producing the steel which was to take the place of wrought iron to such a great extent. He spoke of the failure of the first trans-Atlantic cable, and the invention by Lord Kelvin of the siphon recorder. Dr. Unwin mentioned that he had been a member of the Institution of Civil Engineers for more than 50 years, and had received a liberal education from the papers he had heard read before the Institution.

In conclusion of the proceedings, votes of thanks were accorded Mr. Balfour (who briefly responded) and the chairman.

Conditions of Living and Prospects in Brazil.—In our issue of April 15th a correspondent inquired as to the climate of Brazil and the prospects of the electrical industry in that country. As a result, we have received from the *South American Journal* a publication entitled "South America as a Field of Travel" (January, 1921; price 1s. 2½d., post free), which deals with the characteristics of the various South American Republics individually at considerable length; anyone who contemplates a sojourn in South America will do well to obtain a copy. The account given of the beauties and other amenities of Rio de Janeiro presents a highly attractive picture, and a full description is included of Sao Paulo, the second city of the Republic, concerning which our correspondent specially inquired. Comparatively recent improvements have resulted in "transforming this insanitary, old-world town to a bright, healthy, and beautiful city." The town of Santos, the port of Sao Paulo, was formerly "most unhealthy and a nest of yellow fever, but an excellent system of sanitation and drainage has completely eradicated this disease." The possibilities of this great Portuguese Republic are, like its area, immense, and a great deal of information regarding them is given in the brochure, which also deals with Argentina, Chile, &c.

Fire. — The main sawmills department of Messrs. Charles Jenkins & Sons, timber merchants, Rheola Road, Porth, equipped with complete electrical machinery, and one of the most extensive in Wales, was destroyed recently by a fire which did £4,000 damage. The brigade was able to save the large carpentry shops with their expensive electrical plant. The damage is covered by insurance.

The Batti-Wallahs' Society.—At the Batti-Wallahs' lunch at the Holborn Restaurant, on May 9th, at 1 o'clock, the speaker will be Canon H. Bickersteth Ottley, of the Royal Chapel of St. Katherine, Regent's Park. He is a member of the League of Nations Union, and will take the League of Nations as the subject for a short address.

Californian Projects.—According to Mr. F. G. Baum, consulting engineer to the Pacific Gas and Electric Co., in the Pit River scheme a pressure of 220,000 V will be used, because it costs less than a lower pressure would. It is intended to transmit 150,000 kVA per circuit. From the generating station to the first sub-station the distance is 200 miles, and from the first to the second sub-station 260 miles.

INSTITUTION NOTES.

Institution of Electrical Engineers.—In connection with the election of the Council of the Institution, the E.P.E.A. is recommending its members to support the following candidates for election as ordinary members of the Council :—Lieut.-Colonel F. A. Cortez-Leigh ; Messrs. A. Page, T. Roles and W. C. Tapper.

Liverpool Sub-Centre of the North-Western Centre.—The report of Committee for the session 1920-21 shows that eight ordinary general meetings have been held, with an average attendance of 74. The annual general meeting was held on April 25th, at which Prof. E. W. Marchant, D.Sc., and Mr. H. Dickinson (city electrical engineer) and Messrs. A. J. Eames, J. Hamilton, A. E. Malpas, P. Priestly, and P. J. Robinson, together with past chairmen, were elected members of the Committee. Mr. G. E. Nisbett was elected chairman, Messrs. B. Wellbourn and E. M. Hollingsworth vice-chairmen, and Mr. Oscar C. Waygood hon. secretary. The grant to meet the expenses of session 1920-21 was £120. The total expenditure amounted to £116, leaving a balance in hand of £4. The membership of the Sub-Centre amounted to 367, an increase of 73. The area has been extended definitely to include the members in the Wigan and Southport districts. The Students' Section has made remarkable progress during the session. It has held four general meetings, and made two visits to works.

Western Centre.—The 22nd general meeting of the Centre was held at Bristol, on May 2nd, and a good audience assembled under the chairmanship of Mr. A. J. Newman. Additional interest was shown in this meeting, as it had been announced that the President of the Institution (Mr. Ll. B. Atkinson) would give an address. After the transaction of routine business, the President was found in his best form and lectured on "Four Great Electric Lights," taking as his basis Faraday the discoverer, Maxwell the interpreter, Kelvin the measurer, and Silvanus Thompson the teacher. Subsequently, a complimentary dinner was held to enable members to meet the President, and a capital musical programme was rendered by Miss O'Gorman, Messrs. J. G. Royce, L. Dore, and Huntingdon. We hope to give fuller details in a later issue.

Diesel Engine Users' Association.—At the last meeting of the Association the question of "Lubricating Oils Suitable for use in Diesel Engine Air Compressors" was considered. The meeting was unanimous on the point that whatever quality of lubricating oil was used in the air compressor, the smallest practicable quantity should be introduced. The recommendations with regard to oils suitable for use for lubricating air compressors which were finally adopted for inclusion in the report on "Air Compressor Explosions and Troubles," issued by the Association in 1916, stated that the oil should be entirely free from suspended particles of water, sand, or other impurities, and from inorganic acids. It should in no case be lower in closed flash point than 350° F. Both straight mineral oils and compound oils containing small quantities of saponifiable oil have met with success on Diesel engine compressor service, but the majority of successful oils have been straight mineral oils.

Illuminating Engineering Society.—A paper on "Ship Lighting in Relation to Comfort, Safety, and Efficiency," was read before the Society, by Mr. W. J. Jones, on April 26th. The speaker said that the question of efficient lighting in warships had received greater attention in America than it had in this country, and charts showing the intensities required in various departments of a vessel had been drawn up. With regard to the lighting of liners, Mr. Jones said that the modern requirement was from 10,000 to 12,000 lamps, as compared with about 1,200 20 years ago.

In the subsequent discussion, Mr. Fletcher, of the Admiralty, spoke of the trouble due to eye-strain being experienced in the Navy, and said that "daylight" illumination had not met with any marked success.

Warrington Electrical Society.—The Society has just held its second annual meeting, and in the course of the discussion of the next season's syllabus, it was suggested that visits should be arranged to the larger works of the town. Mr. F. V. L. Mathias was re-appointed chairman ; Mr. Smith, vice chairman ; Mr. J. B. Robertson, secretary ; Mr. H. Rogers, treasurer ; and Council : Messrs. Brooking, Seymour, Baird, Senior, Leggatt, Sykes, Bishop, and Barton.

Glasgow Corporation Electricity Department Engineering Society.—Formed three years ago to encourage the interchange of technical information and otherwise to further the interests of the members, the Society has just concluded a most successful session. There are now 300 members on the roll. The papers contributed and discussed during the session covered a wide range of subjects of special interest to electricity supply engineers. The Society meets once a month during the winter, and the meetings are open to all employés of the department.

Birmingham and Midland Institute Scientific Society.—The annual report states that the society's laboratory and library have been arranged as in pre-war days, and are available at all times for experimental work, and a selection of instruments has been purchased by the society for wireless telegraphy and telephony, which are being added to from time to time, and it is hoped that in the near future the wireless room will be complete with all instruments necessary for reception and transmission. Several demonstrations have already been given, and a great deal of experimental work carried out. The members interested in this branch of science meet on most Tuesday and Thursday evenings for Morse practice, wireless lectures, both elementary and advanced, and examination and explanation of wireless instruments.—*Birmingham Post.*

Royal Institution.—At the annual meeting, held on the 2nd inst., the Report of the Visitors for the year 1920, testifying to the continued prosperity and efficient management of the Institution, was read. The following were unanimously elected as officers for the ensuing year :—President, the Duke of Northumberland ; treasurer, Sir James Crichton Browne ; secretary, Colonel E. H. Grove-Hills.

British Science Guild.—The annual dinner was held at the Hotel Cecil on Tuesday, Lord Montagu of Beaulieu, the president, being in the chair.

Iron and Steel Institute.—The annual dinner, fixed for yesterday, was abandoned on account of the conditions prevailing in the coal, iron, and steel industries.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

The London County Council Highways Committee recommends that Major A. E. Carr, D.S.O., power station superintendent, L. and Y. Railway Co., be appointed repairs superintendent at Greenwich power station in the electrical branch of the tramway department, and that Mr. A. G Evans (assistant engineer, Messrs. Preece, Cardew and Rider) be appointed technical assistant (Grade I) in the electrical branch of the tramway department. The commencing salary in each case is £300 (based on pre-war conditions), with temporary additions, the total remuneration on the present bases of rates being £590.

Mr. W. M. Valon, for 11 years manager and engineer of the Corporation Gas Works at Stafford, has accepted the position of technical director with Messrs. Major & Co., chemical distillers and dye makers of London. At a farewell gathering last week, he was presented with a portable typewriter from the staff and employés of the Gas and Electricity Departments.

Mr. W. J. Talbot, who acted as vice-president last year, was last week appointed President of the Walsall Chamber of Commerce. He was for two years electrical engineering lecturer at Walsall Technical Institute. About 18 years ago he became engineer and manager of Messrs. John Russell & Co.'s seamless tube works, and later with Dr. G. Stead established the Talbot-Stead Tube Co., Ltd. He is chairman of the Electricity Committee of the Walsall Town Council.

Halifax Tramways Committee recommends the Council to grant an honorarium to Mr. J. W. Galloway, tramway engineer, for his extra services during the period of the illness of Mr. J. D. Caird, traffic manager, and until the new general manager (Mr. B. Hall, of Wigan) commences duty.

Mr. George Watson, consulting engineer, of London, has been engaged as consulting engineer to Accrington Corporation in connection with extensions to the destructor works at a fee of 200 guineas, plus out-of-pocket expenses.

Barnstaple Town Council has granted a gratuity of £100 to Mr J. Hadfield, electrical engineer, in respect of extra services rendered by him in connection with the installation of new plant.

Mr. J. S. Craig, late of the switchgear sales department of the Metropolitan-Vickers Electrical Co., Ltd., has been appointed representative of the Cantie Switch Co., Ltd., for Lancashire and Yorkshire district.

Lancaster Corporation has adjourned for six months a recommendation by the Finance Committee to increase the salary of Major G. C. Milnes, electrical engineer, from £500 to £600. It was stated that the salary was £275 in 1914, and was increased on Mr. Milnes's return from the war to £500. Mr. Tester, a predecessor, received £370 in 1904, when the units sold were 333,834. Now they were 628,000 for lighting, and just under a million for power. According to other authorities, the scale would be £670.

Mr. J. W. Wilkinson now has no connection with the firm of "Wolf Brothers," of 9, Warwick Court, W.C. 1, the partnership firm of Wolf Brothers & Wilkinson having been dissolved as from February 28th last. For the present, however, Mr. Wilkinson is

retaining his office at the above address, and is carrying on his consulting work in connection with the electrical driving of mills, factories, and mining machinery alone.

Mr. Fred. C. Gibbons, M.I.E.E., managing director of Messrs. Browett, Lindley & Co., Ltd., has also been appointed chairman of the company.

Mr. Hugh S. Davidson, who has resigned his position as manager of Messrs. Malcolm & Allan, Ltd., London, was the recipient, on Monday, of a gold watch and chain. The presentation was made by Mr. Butler, in the presence of a deputation on behalf of the London staff. During the 10 years Mr. Davidson has been with the firm he has been responsible for the carrying out of numerous contracts of all descriptions, including a very large one at the Motor Transport Depôt, Slough.

Obituary.—Mr. Wm. E. Bull.—We regret to record the death, which occurred on April 27th at his home, 89, Upper Tulse Hill S.W., of Mr. William E. Bull, senior London representative for Messrs. Falk, Stadelmann & Co., Ltd. Mr. Bull had been connected with the illuminating trade since boyhood, entering the business of Prince & Symmons, Commercial Street, E.—one of the pioneer firms in the oil-lighting trade—in 1874. He joined Messrs. Falk, Stadelmann in 1901, and soon secured a large circle of friends, by whom he will be missed. He was an ardent swimmer, being president of the Amateur Swimming Association. Well known in Masonic circles, he had been secretary of the Shepherd's Bush Lodge for the past 21 years.

Will.—The late Sir R. P. Ashton (of Kilburn, Brown & Co.), who was deputy-chairman of the Enfield Ediswan Cable Works and a director of other companies, left £26,239.

NEW COMPANIES REGISTERED.

"Alfo" Electrical Engineering Co., Ltd. (174,379).—Private company. Registered April 25th. Capital, £2,000 in £1 shares. To carry on the business of electrical engineers, &c. The permanent directors are: H. Y. Fowler, 35, Draycott Street, Dingle, Liverpool; W. F. Almond, 64, Park Road, Liverpool. Qualification: £250. Secretary: W. F. Almond. Registered Office: 37, Moorfields, Liverpool.

Riley Patents, Ltd. (174,390).—Private company. Registered April 25th. Capital, £5,000 in £1 shares. To acquire from G. B. Riley and others for exploitation in the United Kingdom, the U.S.A., Canada, and Newfoundland an invention relating to loud-speaking telephones, and to carry on the business of manufacturers of and dealers in telephones and telephone apparatus, either in metal, rubber, wood, china, glass, composition, or other material, manufacturers of electrical, wireless, and other clocks, motor pumps and motor accessories, &c. The subscribers (each with one share) are: S. C. Peacock, 10, Hanover Square, W.1, director of Kendall, Glaude & Co., Ltd.; C. W. Grogan, 47, Stanhope Gardens, South Kensington, W., mining engineer; C. F. Spens, 11, Haymarket, S.W., export merchant. The subscribers are to appoint the first directors. Qualification: 1 share. Registered office: 20, Denman Street, W.

Moodys, Ltd. (174,389).—Private company. Registered April 25th. Capital, £1,000 in £1 shares. To adopt an agreement with A. E. Moody and V. H. Moody, and to carry on the business of electrical engineers and contractors, manufacturers of and dealers in electrical materials and goods, &c. The first directors are: A. E. Moody, 24, Hungerford Road, Holloway, N. (managing director); V. H. Moody, 1, Craven Park Road, Harlesden, N.W.10; B. Guest, 108, Craven Park Road, Harlesden, N.W.10. Qualification: £1. Remuneration: 5 guineas each per annum. Secretary: B. Guest. Solicitor: E. E. Winterbotham, 1, Fredericks Place, Old Jewry, E.C.

Premier Private Telephone Co., Ltd. (174,408).—Private company. Registered April 26th. Capital, £2,000 in £1 shares. To acquire a certain patent for an invention relating to improvements in telephones, and to adopt an agreement with J. Kay and J. Jennings. The permanent directors are: E. C. Aspden, 92, Grenville Street, Stockport; A. L. Barnes, 47, Bloom Street, Stockport; J. Kay, 120-122, Castle Street, Edgeley, Stockport; A. Dutton, 78, Castle Street, Edgeley, Stockport; G. E. Pennington, 60, Torkington Street, Stockport; S. Ridgway, 95, Chatham Street, Stockport; G. Trafford, 5, Lord's Avenue, Weaste, Salford; D. Wallace, 42, Carson Avenue, Rusholme, Manchester; W. S. Whittaker; 65, Wellington Street West, Higher Broughton. Solicitor: S. Bishop, 23, Fountain Street, Manchester.

Heads (Electrical), Ltd. (174,402).—Private company. Registered April 26th. Capital, £3,000 in £1 shares. To take over the business of manufacturers of electrical accessories, and motor and general engineers carried on by J. Rest, W. Rest, C. H. Carter, and F. Allandale, at 11, Noel Street and 165, Wardour Street, W., as the "J. R. C. Manufacturing Co." The first directors are: B. M. Head, 20, Goldsmid Road, Brighton (permanent managing director); J. Rest, 6, Dumbarton Road, Brixton Hill, S.W.; C. H. Carter, 40, Wilson Road, Camberwell, S.E. Remuneration of B. M. Head not less than £4 per week from April 16th, 1921, in addition to travelling and incidental expenses. Solicitor: G. F. Donne, 58, Ship Street, Brighton. Registered office: 165, Wardour Street, W.

Sheet Metal Plating Co., Ltd. (174,426).—Private company. Registered April 27th. Capital, £5,000 in £1 shares. To adopt an agreement with H. J. Hunt and H. J. Vince, and to carry on the business of electro and other platers, welders, electrical and water supply engineers, founders, &c. The subscribers (each with one share) are: A. H. Lister, 325, Kingston Road, Merton, S.W., carman and contractor; H. J. Hunt, 42, Meyrick Road, Clapham Junction, S.W.11, sheet metal worker. The first directors are: H. J. Hunt (life director, subject to holding 200 shares) and others to be appointed by the subscribers. Secretary: A. J. McCarthy. Registered office: 20, Finsbury Square, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Packham & Son, Ltd.—Satisfaction in full on April 7th, 1921, of first and second debentures dated November 27th, 1914, securing £1,200 and £1,111 10s. respectively.

Vickers-Petters, Ltd.—First mortgage debentures, dated April 11th, 1921, to secure £75,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: W. H. Gillett and W. K. T. Risk, 39, Threadneedle Street, E.C.

E. S. Co., Ltd.—Satisfaction to the extent of £3,000 on March 24th, 1921 of debentures dated November 17th, 1920, securing £6,000.

East Anglian Electricity Co., Ltd.—(a) debentures for £3,300, created 1898-1900, have just been registered chiefly under Section 12 of the Companies Act, 1907; (b) satisfaction in full of £2,950 debentures dated 1898 to 1914 has also been registered, the actual dates of repayment ranging from January, 1909, to January, 1921.

Pleno, Ltd.—Mortgage dated April 11th, 1921, to secure £150, charged on 35 and 37, Anker Street, Nuneaton. Holders: Trustees of Lily of the Valley Lodge, Order of Oddfellows, Wolvey, Warwick.

English Electric Co., Ltd.—Conveyance dated April 12th, 1921, supplemental to trust deed dated September 15th, 1919, securing £1,000,000, charged on various properties in Preston, Coventry, and Ashton-upon-Ribble. Trustees: Debenture Corporation, Ltd.

Brotherton Ediswan Tubes & Conduits, Ltd.—Particulars of £40,000 debentures, authorised April 7th, 1921; whole amount issued, charged on the company's undertaking and property, present and future, including uncalled capital, subject to prior charges.

Martin & Element, Ltd.—Particulars of £6,500 debentures, authorised March 24th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Charles W. Webber, Ltd.—Mortgage dated April 4th, 1921, to secure £2,000 charged on 33-5-7, George Street, Weston-super-Mare, with stable, garage, &c., in rear thereof. Holder: H. W. Rendle, "Oakdene," Severn Road, Weston-super-Mare.

Wilson, Hartnell & Co., Ltd.—Assignment dated April 11th, 1921, to secure all moneys to become due to mortgagees under a specified order, charged on account against Turton Urban District Council for the supply and erection of overhead mains, poles, sections, boxes, underground cables, &c. Holders: British Insulated & Helsby Cables, Ltd.

Julius Sax & Co., Ltd.—Satisfaction in full on March 22nd, 1921, of mortgage debentures dated October 27th, 1908, and February 15th, 1909, and July 9th, 1915, securing in all £3,500.

Patex, Ltd.—Issue on April 14th, 1921, of £50 debentures, part of a series already registered. (Previously issued, £2,400.)

Telegraph Manufacturing Co. (Colonial), Ltd. (71,854).—Return dated March 22nd, 1921. Capital, £2,000 in £1 shares. All shares taken up and paid for in full. Mortgages and charges: Nil.

Cutting Brothers, Ltd. (81,178).—Return dated December 1st, 1920. Capital, £40,000 in £10 shares (3,000 ordinary and 1,000 preference). 1,877 ordinary and 502 preference shares taken up. £20,580 paid (being £10 per share on 1,477 ordinary, 502 preference, and £2 on 400 ordinary). Mortgages and charges: £30,000.

CITY NOTES.

Indo-European Telegraph Co., Ltd.

Mr. J. Herbert Tritton presided on April 27th at the annual meeting, held at 18, Old Broad Street, E.C. He said that whilst the report was for the year 1920, the accounts were those for 1918, the latest they could furnish for the moment, though they hoped before the end of the summer to present those for 1919. Reviewing the accounts for 1918, with regard to the Russian assets, a full statement was made in the last report. The main position with regard to those assets remained as then outlined, except that normal accretions of interest, &c., had slightly increased the item of Russian Government debts to £97,223. The directors wished, however, to state that they regarded it as an imperative duty to deal with the question of those doubtful assets, and they hoped at the next general meeting to inform the shareholders of the method they proposed to adopt. They had satisfied themselves that, apart from the Russian items, the entry under sundry debtors contained nothing that was not worth its face value. With regard to the market value of the investments, omitting the Russian assets, those, at the date of the balance sheet, showed an appreciation over 1917. He was pleased to be able to inform them that they had, under the Peace Treaty, recently been paid by the German Government the full value, together with dividends and accrued interest, of the 200,000 marks Prussian 4 per cent. Treasury bonds (matured in 1917) standing under unappropriated investments. With regard to the financial position at the moment, he must remind them that the equalisation of dividends fund was now exhausted with the exception of about £3,000, and that, therefore, a larger dividend than 7 per cent. for 1921 could not reasonably be expected. Turning to the report, the year 1920 had been a year of disappointment for directors and shareholders alike. Since their last meeting trouble after trouble had supervened in Eastern Europe and in the Near East, and they had found it impossible to maintain their existing position in many sections of the line, their officials and staff having, in many instances, to be withdrawn. Complications in the Near East also extended to Persia, culminating in the threatened withdrawal of the British troops from that country and the enforced evacuation of the families of all telegraph and other officials residing in Persia. He was sure the shareholders would join with them in an expression of sympathy and thanks to those members of the staff and their families who, in those repeated migrations, had had to face dangers and difficulties of every description. Their thanks were particularly due to Mr. Watt, one of their representatives abroad, who faced with great courage the possibility of serious personal danger whilst carrying out his missions from the company. Their representative in Teheran remained at his post and was doing all in his power in the interests of the company. The Persian Government having surmounted their difficulties, would be in a position doubtless to further the re-establishment of the company's telegraph system cross-

ing their country which, meanwhile, was in a state of suspended animation, though the international importance of the route seemed greater than ever. He had informed them sufficiently of their troubles, and they might realise what their anxieties had been during the year under review. Happily, however, he could present a less depressing report. Their arrangements with Germany presented no difficulty in theory, although for reasons of which they would be fully aware, they were not at the moment able to reach a definite conclusion of the negotiations. Negotiations with Poland reached the final stage after a visit which their colleague, Mr. Axel W. Berg, made to Warsaw for the purpose, and it might well be that the reconstruction and repair work on that section might begin in the early summer. Owing to its having been in parts the battlefield of contending armies, that portion of the route naturally required a considerable amount of work. With regard to that section of the route which was controlled by the Soviet Government, he was pleased to inform them that they had learned from the Moscow Government that, in principle, there was no objection whatever to the conclusion of an arrangement by which their line would transit that territory on its old ground. The directors had also reason to hope that where the influence of the Soviet Government might be needed in territory which might be described as more or less debateable ground, it would be exercised in favour of the company. They would thus see that the directors were once more encouraged to hope that all might, within a measurable space of time, be again well with the company, and that reconstruction and consolidation might everywhere be begun along the route. It was only in the Polish section that reconstruction over a considerable distance might have to be faced, and even there they were confident that by the utilisation of temporary links pending permanent reconstruction they would very quickly supply a workable line. For material they would certainly not be delayed; the greater part of it was ready at convenient points waiting to be handled. During the enforced inactivity of the company the directors had devoted a certain amount of time to the development of radio-telegraphy. Experiments on the Galletti system had perforce to be abandoned owing to the intervention of the war, and it had not been found possible to resume them. Whilst the company had, therefore, ceased to interest itself in any one system, certain radio patents and assets held by them had, together with the experience of the directors, been placed at the disposal of a new company, the Radio Communication Co., Ltd., against a substantial holding of shares. That company, having standardised various sets of apparatus, was doing very considerable business, particularly in the supply and working of sets on ships belonging to some of the foremost shipping companies in this country, and the directors considered that the investment should prove to be in every way a profitable one. It was in connection with their wireless work that he reserved for comment an item in sundry debtors in the 1918 accounts of advances (then £11,000, since increased to £13,000) made to the Galletti Co. The directors were of opinion that those advances were fully secured by the fact that they had a controlling interest in the assets of the Galletti Co., which included not only an important number of shares also held by that company in the Radio Communication Co., but a good claim against the French Government for compensation for requisition and appropriation during the war of the plant of the Galletti station in France.

Mr. Charles Holland seconded the motion, which was carried without discussion.

North Metropolitan Electric Power Supply Co.

Mr. E. Garcke, in his speech at the annual meeting, held on April 27th at Electric Railway House, Westminster, said that the net revenue for the year 1920 was their record figure, and the result would have been even better had it not been for the depression in trade. The net revenue, including interest and dividends received, was £101,354, compared with £65,868 for 1919. They were recommending a dividend on the ordinary shares at the rate of 7½ per cent. for the year, compared with 4½ per cent. for the previous year. The result was satisfactory, especially in view of the fact that the expenses of working—particularly the item of coal—had increased considerably. The improvement was in a measure due to the revised rates of charges introduced as from April 1st last year. A judgment had been obtained by the company for the annulment of a pre-war contract for the supply of electricity in bulk to the Stoke Newington Council, and in future it would be on their standard terms. This decision of the Court had, moreover, enabled them successfully to negotiate with the Middlesex County Council for a revision of the rates of supply to the Metropolitan Electric Tramways. Satisfactory arrangements have now been made for a revision of the price. A large number of new contracts had been made with consumers who required a supply for power purposes, and important bulk supply contracts had been entered into with the Harrow Co. and the Welwyn Garden City for distribution in their respective areas. Arrangements had had to be made for providing additional plant and cables to enable the company to supply the increased demand, and £87,000 had been expended on capital account during the past year. Further capital expenditure would be necessary during the current year. For this reason the authorised share capital of the company had been increased by £500,000 to £1,500,000 under the powers contained in the North Metropolitan Power Supply Act, 1920. The Electricity Commissioners have delineated a provisional area, which was described as "The London and Home Counties Electricity District," in which the area of supply of this company had been included, for the formation of a Joint Electricity Authority, in combination with the electricity supply undertakings owned by local authorities and companies in the metropolitan area. The directors were opposing the proposal to the extent that this company should be left out of the scheme. The position of this company was very different from that of an ordinary electricity supply company. Its powers to supply had been granted in perpetuity, and it was not subject to compulsory purchase at any time. The area of this company's supply was an exceptionally favourable one, and was rapidly developing for industrial purposes, and the demand was steadily increasing. The development during the next few years would be as rapid as in the previous years. The results of the first quarter of 1921 were very satisfactory, and, given normal industrial conditions, there was every indication that the results for the current year would show still further improvement.

English Electric Co., Ltd.

Sir Charles E. Ellis (chairman) presided on April 27th, at the Connaught Rooms, Great Queen Street, W.C., over the second ordinary general meeting of this company. The chairman, in moving the adoption of the report, said he would like, in the first place, to point out that, although the total of the credit side of last year's profit and loss account amounted to £410,835, that figure, as was clearly shown in last year's printed accounts, included a special item of £230,000, representing undivided profits brought in by certain subsidiary companies at the date of amalgamation. Although these particular profits appeared in the profit and loss account, they would remember that they were applied in creating a capital reserve account and in writing off the expenses of their debenture issue, &c. It was obvious, therefore, that this £230,000 could not be taken into account when comparing the results of the two years. As regarded the balance sheet, if they took the liabilities side first, they would observe that the share capital had been increased since the date of the previous balance sheet. This addition was explained in detail last year, and arose out of certain arrangements with their subsidiary and allied companies. The issue of 8 per cent. 6-year notes had been alluded to in the report. For some little time after the amalgamation, it was extremely difficult to forecast the volume of working capital that would be required. Experience showed, however, that the amount provided by the constituent companies and at their disposal was insufficient, more particularly in face of the steady rise in the prices of material; and the provision of further funds by way of a short-term loan was decided upon. The issue affected their accounts this year to the extent of only £150,000, the balance being received early in January. In the opinion of the board, the company was fortunate in making this issue in November last; had the issue been deferred to a later date, the subsequent stringency of the money market would have debarred them from securing equally satisfactory terms. They would have seen from the report that they had written off the whole of the expenses of this issue. Seeing that these notes were for the short term of six years, they had also considered it prudent to provide for the whole of the premium payable on redemption, which had been done without encroaching upon the capital reserve account set aside last year. They would thus appreciate that the profits of future years would be entirely relieved from the dead-weight both of the expenses of, and the premium on, this issue. Of the remaining items in the balance sheet, the sundry creditors showed a considerable increase this year, which, however, was more than set off by the new item of "Stock, work in progress, &c.," and the increase in the sundry debtors. He might explain that the appearance of stocks and work in progress in this year's accounts represented a further step in the gradual process of consolidating their allied concerns. He hoped that in the year 1921 they would be able to make still more progress in this direction, and that the next balance sheet would reflect the company's undertaking in a still simpler form. During the last year their principal task had been that of consolidating the company's organisation. Satisfactory progress had been made in the adaptation of the Coventry works and the restoration of the other factories to their normal activities. They had proceeded, with the least possible delay, to the application of their fixed policy of devoting each works to the manufacture of that class of machinery for which, by reason of its lay-out and past history, it was best adapted. It was obvious that the rapidity with which any such re-arrangement could be carried through must depend to a great extent on the contracts in course of execution at each works; but it was gratifying to be able to record that, in spite of the volume of work in progress and the necessity of taking no action which would impair their power to meet commitments, substantial progress had, in fact, been made towards their ultimate scheme for the best possible utilisation of their five works. They recognised, however, that the successful working of any scheme depended above all on continuous team work by their staffs, not only in each works, but between each works and the rest. He could not let pass this opportunity of acknowledging what they owed to those staffs. They had worked loyally and without losing their individuality for a corporate interest. To return to the

special functions of their works, at Coventry they had manufactured turbine-electric units of very large sizes, rolling mill equipments, and the larger classes of engineering products. Preston had for long been well known as an important centre of traction work, it had now specialised even more completely in that branch of the industry, and at the present time electric locomotives, in addition to all forms of electrical traction equipment, were being manufactured there. At Rugby and Stafford the manufacture respectively of the medium sizes of steam turbines and of electrical generating and industrial machinery had been further developed. The Bradford works, which had been specially laid out for the smaller range of industrial motors, had now in addition their own machine moulding plant. Like all other engineering firms they were dogged throughout 1920 by the unfortunate effects of the moulders' strike, which began in 1919 and was protracted into the early part of the year, but in recent months there had been a welcome improvement in the foundry position. They had been able to enlarge and improve the foundry capacity of their own works, and thus to become to a greater extent independent of outside suppliers. Their business, both at home and abroad, was well maintained up to the later months of the year, but the general depression which began to affect the steel and kindred industries in the early autumn became noticeable in the electrical trade a little later. They had, fortunately, a considerable order book still to be executed, and it was not unreasonable to hope that in all except the smaller classes of their manufactures the flywheel action of this volume of orders would be sufficient to carry them over until trade revived. He referred a year ago to the importance of railway electrification proposals for the future of the electrical industry. Since then little progress had been made with the electrification of railways in the United Kingdom; but the delay was due mainly to difficulties of finance, and the technical advantages of electrification were not in dispute. In this connection it would be of interest to them to learn that the execution of the contract which the company obtained last year from the New Zealand Government for the electrification of the Arthur's Pass section of the Midland Railway of New Zealand was proceeding satisfactorily. Amongst the problems to which the board had devoted its most anxious attention had been the enforcement of economy in selling expenses at home and abroad. To this end he was glad to report that their working arrangement with Siemens Bros. and Co., Ltd., to which he referred last year, had been followed by the formation of the English Electric & Siemens Supplies, Ltd. This company (the capital of which was held by Messrs. Siemens and themselves in equal parts) would deal exclusively with marketing the minor products of the two concerns and electrical supplies generally. It had taken over their former subsidiary company, the English Electric Supplies, Ltd., together with a section of the selling organisation of Messrs. Siemens, and should effect a definite saving in that side of their work. If they looked at the labour position, he should wish to say in the first place that as a firm they had in the main no complaint to make as to the manner in which their workmen had settled down to work. They had worked hard and well; and through their ready co-operation on the Works' Committees their differences of view had been brought to light as soon as they had arisen, and had shown themselves in all cases susceptible to treatment by a full and frank discussion. None the less, it was certain that the wages rates in British engineering, and even more those in the industries from which they drew their materials, had led, and were leading to, the loss of many important contracts in world competition. Their raw materials were to a large extent the highly finished products of their suppliers; and if they were to extend or even fully to regain their pre-war business abroad, considerable reductions would be necessary in the price of those products, and, therefore, in the cost of the whole range of processes through which they were built up from the basic materials of coal and iron. How these reductions were to be brought about in a perfectly fair way he did not propose to discuss then, and would only say he had no doubt whatever that they would be able to meet the crisis if both employers and workers would be sure that the necessary sacrifices were distributed as fairly and equitably as was humanly possible over all those concerned. The immediate future must be an anxious time for every industry. Apart from wages and all questions of internal organisation, every industry had to-day to reckon with factors which were essentially political, and therefore beyond its control, yet which exercised a profound influence on the whole system of international trade. They could, however, say this with confidence, that whether a revival of trade came soon or late—and that it would come sooner or later no one could doubt—the electrical industry had an assured future, because it was bound up with those improvements and economies in productive organisation which they all, he thought, regarded as a necessary element in the future prosperity of the world.

Mr. W. L. Hichens (deputy chairman) seconded the motion.

A shareholder pointed out that it was proposed to wind up the United Electric Car Co., but in a previous report it was stated that the works were well equipped and constituted a very valuable asset to the company.

The chairman said the works still remained the property of the company; it was only a winding up for better organisation.

The report was adopted.

British Electric Transformer Co., Ltd.

The annual meeting was held on Friday last at Winchester House, E.C. Mr. A. F. Berry, who presided, first referred to the death of Mr. F. J. Marchment, who had been a director of the company for 15 years. He said that the issued capital now stood at £625,000. Sundry creditors amounted to nearly £95,000 more than last year, owing to the increased business done and being done. It was proposed to add a further £3,000 to the depreciation reserve account, making the total £23,300. The stock of materials stood at more than double the figure at which it stood in the previous balance sheet. That asset had been valued by the manager, as in past years, on a conservative basis. The "work in progress" amounted to nearly double last year's figure, and no profit had been taken into account on that work. Sundry debtors stood at about £41,300 more than last year, and they were all considered good, and since December 31st the sum of £98,790 had been received on account of them. With regard to the profit and loss account, general charges had increased by about £12,000, while the gross profit had been increased by about £23,000 and the profit for the twelve months had been increased from £48,038 to £70,266. The available balance amounted to £80,790. The dividend on the ordinary shares was at the same rate as for 1919. With regard to the working for the current year, they started with 50 per cent. more work in hand (money value), or 30 per cent. more in horse-power than they had at the beginning of 1920. It would interest original shareholders to note that in the last ten years the company had made far more rapid progress than it did in the first fifteen years of its life. In the last three years it greatly extended its operations, and, had it not been for strike and lock-out troubles, which lost them about one month's output in one way or another, they would have shown still greater progress. The year under review had been most difficult. The future was always difficult to foretell, but given the support of all from whom they had hitherto had it, and whose interests were best served by giving it, they could look forward to full-time employment and a continued improvement in trading results. It was essential in a business such as theirs to aim high, and it was only by strong and united action that they were able to keep so fully employed. Nothing succeeded like success, and he had confidence that, as they were having to reduce prices to secure work, they might rely on the necessary increased effort from their shops, even though they had, as they should have, to pay wages more in accord with the reduced cost of living. The next few years would test the capacity of even the best captains of industry. It would be most difficult to restart businesses that had stopped or speed up the output of those which had slowed down. Their business was, by reducing costs of production, to see their order sheet kept well filled well ahead. He was very disinclined to support any attack either upon the Government or Trade Unions, for, although he believed that the art of governing was developing, there could be no doubt about the development of attack upon government. There were, however, matters which those of them who were responsible for the creation and development of an industry would be glad to see handled differently, or not handled at all by Governments and Trade Unions. "Too many cooks spoil the broth" to-day, for Government Departments and leaders of Trade Unions were not in any way naturally fitted to control industry. The men who invented, designed, financed, and organised the manufacture and sale of those British goods which the world wanted were the natural leaders of industry. They were the creative force in the country, with a faculty for providing employment for their people. It was those men, backed by investors, merchants and exporters, who until recently made British trade predominant throughout the world. The overlapping which resulted from Governmental or Trade Union interference with industry had produced most grievous results. The men at the head of Trade Unions did not themselves even pretend that they were naturally fitted to create or direct industry, and he never yet met one who had ever been responsible for the building-up of an industry. Their useful work lay in quite other directions, and should be done without encouraging strife and class hatred, which made the lot of all most difficult. Those who preached "smashing" and "war" were either ignorant, ill-advised or desirous of acquiring some "pieces" that they thought would result from the smashing process. A civilisation that had been built up here from the days of Stonehenge, *i.e.*, some 4,000 years old, might be lightly destroyed, but could not rapidly be changed for the better. Useful endeavour to benefit the people of a country came rarely, if indeed ever, from those who preached sedition, strife and bitterness. It had been his privilege to meet some of the leaders in science and industry, both here and abroad, and he found in them no trace of envy, hatred, malice, or any uncharitableness. Electrical science, like others which were founded largely upon mathematical and natural sciences, had been developed to such lengths that it was difficult, even for those of them who were specialists in any particular lines, to keep ahead of their foreign competitors, unless they were helped, rather than hindered, by their own countrymen who benefited by their labours. He looked forward to the time when the workers in an industry, such as theirs, owned as shareholders a very considerable proportion of the business in which they were engaged. They had made a considerable start in that direction, and nearly 300 of those whose daily work was in connection with the company were

already shareholders. There was only one remedy for unemployment and that was work, and reasonably long hours of good work cheertully done for a fair day's pay. They themselves might well have had another quarter of a million's worth of orders on their books had they been able by overtime or increased effort to give more reasonable delivery. As with them, so with hundreds of firms up and down the land. Not only had orders passed never to return—those orders which would have stood abroad as England's advertisement to secure work for them in the years to come—but actual orders had been cancelled right and left, though he was glad to say not with themselves. It was late to grieve over what might have been—England's trade opportunity at the beginning of 1920 was still a wonderful one. He maintained that even now England's opportunity was enormous, and there were signs that, as ever, the people of this country would now tighten up themselves and take their work in hand with a view to making up for lost time.

Mr. T. Rowe seconded the motion, which, after a short discussion of a congratulatory character, was carried.

River Plate Electricity Co., Ltd.

After providing for all expenses, bad debts, depreciation, and 5 per cent. debenture interest, 7 per cent. is recommended on the ordinary stock for the year, £20,000 being put to general reserve, and £6,982 carried forward. The *Financial Times* states that after the close of the year arrears of amortisation due upon five per cent. obligations of the German Company, amounting to £12,300, were received. The greater part of arrears of interest for the period from 1914-1919 has also been received, but there is still in dispute a sum of over £3,000 in respect of interest in arrears. The board has entered into contract with the Compania Hispano-Americana de Electricidad, which is in process of taking over all the assets in South America of the German Company, under which the Compania Hispano has purchased from this company and paid for £63,600 of the 5 per cent. obligations of the German Company, and, as to the balance of £60,000 then remaining, the company has agreed to accept the obligation of the Spanish Company in place of the obligation of the German Company.

Belgian Investment Companies.

The directors of the *Société Financière des Transports et d'Entreprises Industrielles*, of Brussels, dealing with the working of the supply works and tramways in which the company is interested, record with satisfaction the overcoming of the difficulties in connection with the supply of coal. This had now become abundant, raw materials had become cheaper, and freights lower, and Government restrictions and control were disappearing, the only difficulty now remaining being that of labour. Under the circumstances the situation of most of the undertakings experienced an improvement in 1920. The net profits realised last year amounted to 4,143,000 fr., which allow of the payment of a dividend at the rate of 12 per cent. on the ordinary shares, or 54 fr. free of tax, and 40.45 fr. net on the founder shares.

The report of the *Société Générale Belge d'Entreprises Electriques*, which is an investment company, states that in order to assist in meeting the growing demand for power, a further sum of over 10,000,000 fr. was invested in supply undertakings during 1920. Electricity supply works represent 70.5 per cent. of the value of the company's securities in portfolio, combined supply works and tramways 14.5 per cent., and tramways, purely and simply, 15 per cent. As to the geographical distribution of the securities, it is mentioned that 42.5 per cent. of the investments apply to Belgium, 18 per cent. to France and her colonies, 17 per cent. to Italy, 10 per cent. to Spain, 7 per cent. to the Argentine Republic and Siam, and 5.5 per cent. to Poland, Livonia, Hungary and Russia. The gross profits in 1920 amounted to 4,933,000 fr., as compared with 2,903,000 fr. in the previous year. After deducting the financial charges, the sum of 1,634,000 fr. has been written off for depreciation, particularly of Russian holdings, and the net profits of 1,825,000 fr. permit of the payment of a gross dividend of 35 fr. per share on the old shares, 22.50 fr. on the shares fully paid up during the year, and 10.40 fr. on the founder shares.

German Companies.

The *Lloyd Dynamowerke A.G.*, of Bremen, proposes to pay out of net profits of 513,000 marks a dividend at the rate of 8 per cent. for 1920, these figures comparing with 188,000 marks and 7 per cent. respectively in the preceding year.

The *Concordia Elektrizitats A.G.*, of Dusseldorf, intends to pay a dividend at the rate of 15 per cent. out of net profits of 1,111,000 marks in 1920, comparing with 10 per cent. and 60,000 marks respectively in the preceding year.

The accounts of the *Deutsche Kabelwerke A.G.*, of Berlin-Lichtenberg, record net profits of 3,172,000 marks for 1920, as against 1,392,000 marks in 1919, the dividend rising from 15 per cent. in 1919 to 17 per cent. last year. The directors state that a liquidation of the English participation has not yet taken place.

The *Elektrizitats Lieferungs Gesellschaft*, of Berlin, states that the supply works in which the company is interested experienced an increasing demand, and the installation departments were adequately occupied in 1920. Out of the net profits of 4,631,000 marks, a dividend has been declared at the rate of 14 per cent., as compared with 3,958,000 marks and 12 per cent. respectively in 1919.

The directors of the *Kabelwerk Duisburg*, reporting on the year 1920, state that it was difficult to obtain new orders after April and May, and even the acceptance of delivery of completed manufactures was refused in some cases. The net profits were 12,950,000 marks, as against 990,000 marks, and the dividend and bonus represent 25 per cent., as in 1919. Owing to the growing uncertainty of the economic conditions, the prospects are not regarded as very favourable.

The net profits of the *Sachsenwerk, Licht und Kraft A.G.*, of Dresden, are reported at 8,073,000 marks for 1920, as against 2,245,000 marks in 1919. The directors recommend the payment of a dividend at the rate of 16 per cent. on share capital of 40,000,000 marks, as compared with 20 per cent. on 9,000,000 marks in the previous year. It is now intended to make a fresh issue of share capital for 15,000,000 marks.

The *Ges. fur Elektrische Unternehmungen*, of Berlin, which is an investment company in supply works and tramways and manufacturing undertakings, earned net profits of 8,770,000 marks in 1920, including the balance forward, as contrasted with 5,792,000 marks in 1919. It is proposed to pay a dividend at the rate of 12 per cent. on share capital of 75,000,000 marks, as against 8 per cent. in 1919.

The directors of the *A.G. Mix und Genest* (*Telephone und Telegraph Works*), of Berlin, recommend a dividend at the rate of 15 per cent. for 1920 as compared with 7 per cent. in 1919. At the same time it is proposed to increase the share capital from 12,600,000 marks to 25,200,000 marks. The net profits are returned at 3,150,000 marks, as contrasted with 650,000 marks in the previous year.

The report of *Voigt & Haeffner A.G.*, of Frankfort-on-Main, states that the increased profits realised in 1920 were due to a larger turnover and exchange profits on foreign business. After having made provision for depreciation, the accounts show net profits of 12,920,000 marks, as compared with 1,660,000 marks in 1919, and a dividend has been declared at the rate of 20 per cent., as against 18 per cent. in 1919.

The *Hamburger Hochbahn A.G.* reports net profits of 1,843,000 marks for 1920, as against 764,000 marks in the previous year. It is proposed to pay a dividend of 1 per cent. on the B shares, as contrasted with ½ per cent. in 1919, and 2 per cent. on the A shares, as against 1½ per cent. The rate on the A shares will be increased to 5 per cent. by a payment of the Hamburg State under its guarantee.

The directors of the *Bergmann Elektrizitats Werke A.G.*, of Berlin, report gross profits of 45,155,000 marks for 1920, as compared with 22,162,000 marks in the previous year, the net profits being 13,568,000 marks and 8,488,000 marks in the two years respectively. It is proposed to pay a dividend at the rate of 15 per cent., as against 12 per cent. in 1919, to devote 500,000 marks to provident purposes as in the preceding year, and carry forward 1,068,000 marks. The present share capital of 80,000,000 marks is now to be increased to 100,000,000 marks.

The *Ges. fur Elektrische Hoch und Untergrundbahnen*, of Berlin, proposes to pay a dividend at the rate of 5½ per cent. on the ordinary shares for 1920, being the same rate as in the preceding year. Including the balance forward, the net profits amounted to 4,568,000 marks, as compared with 4,542,000 marks. Fares were again increased, and the total receipts nearly doubled, but the number of passengers carried fell off by 12,000,000, the average fare having risen from 26.66 pfennigs in 1919 to 58.27 pfennigs last year.

Para Telephone Co., Ltd.—The profit for the year was £12,718, plus £6,426 brought forward. The total dividend distribution has been 10 per cent., free of tax. £8,605 is being carried forward. Mr. T. M. Steuart, presiding at the recent meeting, said that although the telephone subscribers had increased during the year, the number was not so large as anticipated owing to the abnormal conditions which existed in Para during the year. A considerable extension had been made in the telephone system in order to incorporate districts hitherto outside the area of the telephone system. The work was nearly completed, and the opening up of the new districts would substantially add to the number of subscribers.

Radio Corporation of America.—The balance sheet at December 31st, 1920, shows: Assets, cash and receivables, $881,507; merchandise inventories, $689,516; investments in Government and industrial bonds, $3,375,210; stocks of associated companies, $550,385; plant and equipment, $8,901,675; deferred charges, $606,669; patents and goodwill, contracts and franchises, $10,107,982. Current liabilities are $1,883,227.

British L. M. Ericsson Manufacturing Co., Ltd.—The annual meeting of this company was held on April 29th. On attendance, a representative of the ELECTRICAL REVIEW was informed that, exercising the power accorded by the Articles, no members of the Press would be admitted.

Aster Engineering (1913) Co., Ltd.—Total distribution for 1920, 7½ per cent., free of tax; £6,000 to reserve for bad debts; £3,635 to depreciation; £40,573 carried forward subject to E.P.D. and Corporation Tax.

City of Buenos Ayres Tramways (1904) Co., Ltd.—A dividend of 1s. 3d. per share, less tax, for three months ending March 31st is announced.

Brush Electrical Engineering Co., Ltd.—It is mentioned in the report for 1920, to which we referred briefly on p. 561 of our last issue, that £91,227 was expended on capital account during the year. £105,244, part of the general reserve fund existing on December 31st, 1919, was capitalised and distributed to the holders of ordinary stock in the proportion of £1 of new ordinary stock for each £1 of existing stock held. The whole of the ordinary stock was then converted into £1 fully-paid ordinary shares at par. In July, 1920, an issue was made of 339,512 ordinary shares of £1 each at par. Of this issue, which was not underwritten, 248,075 shares were allotted in response to applications received. The authorised share capital of the company is now £600,000 in £1 ordinary shares, of which 458,365 shares have been allotted. The directors state that the business generally continues to develop satisfactorily. The new shop in course of erection for the extended manufacture of Brush-Ljungstrom turbo-generators has been delayed owing to difficulties in obtaining delivery of the steel work, but progress has been more rapid of late, and work on the buildings is now active. The demand for these machines and their accessories for electric supply purposes has largely increased. Mr. J. E. Spagnoletti resigned his seat on the board and Mr. C. Shirreff Hilton, a former director, was elected to fill the vacancy. Meeting: May 9th at 88, Kingsway, W.C. 2.

Johnson & Phillips, Ltd.—The directors report that the profit for the year 1920 on trading accounts, &c., after making provision for bad and doubtful debts, and after charging to revenue upwards of £23,000 for maintenance of buildings, plant, &c., amounted to £98,406, plus £63,795 brought forward. After deducting the dividend paid April 30th, 1920, less tax, £30,625, and a bonus of 1 per cent. on first mortgage debenture stock, less tax, £512, the total is £131,064. There are deducted remuneration of directors,' auditors' and trustees' fees, £1,511; interest on debenture stock to December, 1920, £3,657; reserve re debenture sinking fund, £9,227; interest on second debentures to December, 1920, £2,500; depreciation on machinery and plant, &c., £12,236; interest on loans, £4,450; income tax and excess profits duty, £24,312; loss on sale of 4 per cent. funding loan, £2,776; leaving £70,394. The directors recommend a dividend at the rate of 12½ per cent. per annum, less income tax, on the 437,500 ordinary shares, requiring £38,281, leaving to be carried forward (subject to E.P.D. for 1920, and Corporation Profits Tax) £43,113. Meeting held yesterday, Thursday.

Bromley Electric Light & Power Co., Ltd.—Mr. F. E. Gripper presided at the recent annual meeting. He said that the output for 1920 was the largest they had ever had; they had also increased their maximum rate to 10d. These two factors had increased their receipts by £7,607, but the working expenses had also greatly increased. The future prospects were difficult to forecast owing to the strike atmosphere. They hoped to get the benefit of substantial reductions in the cost of coal and other materials. If strikes did not materialise into anything serious, with normal business they might look forward to maintaining the 6 per cent. dividend, and, he hoped, increasing it, as under the present financial conditions 6 per cent. could not be considered an adequate return on ordinary share capital.

North of Scotland Electric Light & Power Co.—The directors report that the connections in Montrose have increased from 1,555 kW to 1,743 kW; in Brechin, from 908 kW to 928 kW, and in Inverness from 2,088 kW to 2,346 kW, making a total of 5,017 kW in the three towns. After providing for interest on debentures and loans amounting to £3,917, writing off £284 from suspense account, and making provision for income tax, amounting to £1,992, there remains a balance of £7,529, plus £729 brought forward. A dividend at the rate of 1¼ per cent. for the year, being the maximum allowed under the Temporary Increase of Charges Act, is recommended absorbing £625; £5,000 is to be placed to renewal reserve account, £2,000 to general reserve account, and £634 is carried forward.

London & Suburban Traction Co.—The revenue for 1920 totalled £51,961. After deducting administration and general expenses, debenture and loan interest, amount paid into sinking fund for redemption of 5 per cent. debenture stock and other expenses chargeable to revenue, and including £1,205 brought forward, there remains £2,098 to be carried forward. Beneficial effect of increased fares was only felt by operating companies during part of the year, while, on the other hand, increased working expenses prevailed throughout the year. During 1920 £14,120 debenture stock was purchased and cancelled, reducing amount outstanding to £271,178.—*Financial Times.*

Pernambuco Tramways & Power Co.—This company announces that the State Government of Pernambuco has granted it, *inter alia*, the right to increase tramway fares subject to the completion of the electrification of the 10 km. of steam tramway and an extension of 6 km. of single track of the suburban electric lines. In order to repay temporary loans, to complete the tramways, and to extend the lighting and power programmes, separate meetings of shareholders and debenture holders are being held to-day to authorise the creation of a prior lien mortgage for £650,000, after which it is proposed in the near future to make a prior lien debenture issue sufficient to provide £450,000.—*Financial Times.*

Bristol Tramways & Carriage Co., Ltd.—Revenue for 1920 £920,775, an increase of £72,695. The working and general expenses and renewals, however, amounted to £988,885. In view of the abnormal conditions of the year, the directors transferred £45,000 from the reserve fund, so that with the E.P.D. repayable and the balance brought forward, the balance at net revenue account is £90,225. Debenture and other interest absorbs £37,497; preference dividend, 4 per cent., subject to income tax, £14,000; dividends of 7 per cent., free of tax, on the ordinary shares, £35,000; carrying forward £3,728. The receipts of the tramways department increased by £160,079, and those of the carriage department decreased by £89,246. Passengers carried on the cars and motor 'buses increased by 12,145,358 to 84,983,434. Increases of fares were authorised as from July 15th, 1920, and February 1st, 1921. Mr. C. Challenger has been elected a director.

Peterborough Electric Traction Co., Ltd.—According to the *Financial Times* the directors recommend dividends of 18 per cent. on the preference shares for the three years ended December, 1920; £768 to reserve; £3,000 to renewals; £6,132 repairs and maintenance; carried forward £932.

Companies to be Struck off the Register.—The following are to be struck off the Register within three months unless cause is shown to the contrary:—

Electric Tramways of Ribeirao Preto Brazil, Ltd.
Midhurst and District Electric Supply Co., Ltd.

Bath Electric Tramways, Ltd.—After providing for repairs and renewals, debenture interest, and preference dividend, £5,000 is put to contingencies and renewals account and £2,305 carried forward.

Chiswick Electricity Supply Corporation, Ltd.—Dividend for 1920, 8 per cent. per annum; to depreciation reserve, £6,500; carried forward, £2,035.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange was closed for a long week-end, and this had the effect of increasing the amount of business which had to be dealt with on Tuesday (to-day), causing an appearance of activity in various markets owing to the execution of accumulated orders. The tone of the markets continues firm, and the Budget as a factor is literally not mentioned. The reduction of the Bank Rate to 6½ per cent. caused surprise, and a certain regret. It was hoped that the Bank would either leave the rate at 7 per cent. or reduce it to 6 per cent., the halfway house being a most unusual halting-place with the Bank minimum standing as high as it is to-day. It is obvious, however, that the Court of Directors are being influenced strongly by the industrial position. From the monetary point of view, there is no justification for holding the Rate as high as it is to-day, and, were the coal-strike to become settled, it would be followed immediately by a drop to 6 per cent. in the rate, with possibly the hint of a further fall in the near future.

This consideration is doing more than anything else to keep steady the prices of investment securities. People with money are still chary of using it for speculative purposes. The new Central Electric Notes make a good illustration of the way in which first-class investments are wanted, for the price has risen to 3¾ premium. The City of London Electric 8 per cent. second preference shares, which started off at 1s. discount when dealings commenced, have already hardened to a shade above the par price of 20s., and on the new ordinary there is a premium of about 1s. 3d. Other newcomers are expected from electrical companies before long, although it may be that the prospectuses will not be issued until after Whitsun.

The demand for electrical manufacturing shares continues, and is a feature of the industrial markets at the present time. Electric Constructions are 9d. up at 17s. Metropolitan-Vickers preference rose 1/16 to 1 11/16 xd. Siemens went up to 24s., but returned to 22s. 6d. English Electrics, also ex dividend, are better at 13s. 6d., allowing for the deduction. Edisons maintain their better position at 12s.

Telegraph manufacturing issues are equally strong. Callender's show 1/16 gain and Henley's ¼. The new Henley's are harder at 27s. In the engineering group, Babcock & Wilcox have stiffened to 2¼, nor has the continuance of the coal stoppage caused any particular diminution of strength amongst the iron and allied companies' shares. Vickers, however, are lower at 13s. 3d.

Cable stocks have again hardened. Eastern ordinary recovered its dividend, and Globes, Eastern Extensions and Westerns are all better on the week. The reason is to be

found in the frequently-repeated statement of the attraction which these stocks and shares offer to the investor, who demands sound security and a net 6½ per cent. return upon his capital. At current prices, the average yield is but little over 6 per cent.—equivalent to 8½ per cent. gross, taking tax at 6s. in the pound.

The upward movement which started last week in London traction descriptions has made further progress. British Electric Traction ordinary is higher at 35½. London and Suburban Traction preference have enjoyed a little activity at the improved price of 6s. 6d., and the ordinary are a trifle firmer at 2s. 9d. Even London United Tramways shares came into the sunlight and changed hands at 4½d. The tube railways are unchanged, Underground Incomes being 71¼, and the A shares 6s. Districts, however, picked up to 15½ and Metropolitans to 26, both being a point higher.

Metropolitan Electric Supply ordinary are ¼ up at 3¾. City Lights, at 23s. 9d., have regained the decline which occurred on publication of the prospectus offering new ordinary and preference.

Mexicans are better in several cases. The first mortgage bonds of the Tramways have risen 2 to 42, and Mexican Light and Power Firsts are 1½ better at 68½. Pernambuco Trams have given way on the issue of the report. Other foreign traction descriptions are not getting much notice. Marconi's touched 2 11/16 buyers; then came back to 2¾. Marconi Marines are a better market at 28s. 3d. Radio Corporations remain at 9s. 6d. for the Common and 11s. 6d. for the preferred. Rubber shares are depressed on the price of the raw produce sinking to 9¼d. per lb., the lowest price touched for many years, and comparing with 12s. 9d. per lb. in 1910, when the rubber boom culminated.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price May 3, 1921.	Rise or fall.	Yield. p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	6	—	£10 0 0
Charing Cross Ordinary	7	8	8¾	—	10 6 6
do. do. do. 4½ Pref.	4½	4½	2⅞	—	7 16 6
Chelsea	4	6	8¾	—	9 12 0
City of London	13	14	1 7/16	+6d.	11 16 0
do. do. 6 per cent. Pref.	6	6	17/-	—	7 1 2
County of London	8	8	7⅞	—	10 9 10
do. do. 6 per cent. Pref.	6	6	8	—	7 10 0
Kensington Ordinary	7	9	4½	—	10 18 2
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	2⅞	—	10 18 2
Metropolitan	6	7	8⅜	+ ¼	10 7 4
do. 4½ per cent. Pref.	4½	4½	3 5/16	—	7 7 0
St. James' and Pall Mall	12	12	6	—	10 0 0
South London	6	7	2¾	—	9 2 10
South Metropolitan Pref.	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	5⅛	—	9 15 2
Telegraphs and Telephones.	1918	1919			
Anglo-Am. Tel. Pref.	6	6	78½	—	7 12 10
do. Def.	33/6	1½	15½	—	9 10 6
Chile Telephone	8	8	5½	—	8 6 8
Cuba Sub. Ord.	7	7	7½	—	9 6 8
Eastern Extension	10	10	16½	+ ¼	6 3 0
Eastern Tel. Ord.	8	10	16 1/16	—	6 3 10
Globe Tel. and T. Ord.	8	10	16¼	+ ¼	6 3 0
do. do. Pref.	6	6	9	—	6 13 4
Great Northern Tel.	22	22	22⅝	+ ⅜	9 13 4
Indo-European	13	10	80xd	+1½	8 6 8
Marconi	25	25	2⅞	+ ⅛	—
Oriental Telephone Ord.	10	12	2⅛	— 1/16	*5 13 0
United R. Plate Tel.	8	8	6⅛	—	6 10 8
West India and Panama	1/3	Nil	7/16	—	Nil.
Western Telegraph	8	10	16½	+ ⅜	*6 1 3
Home Rails.	1919	1920			
Central London Ord. Assented	4	4	44½	—	9 0 0
Metropolitan	1½	1½	26	+1	5 15 5
do. District	Nil	Nil	15½	+1	Nil
Underground Electric Ordinary	Nil	Nil	2	—	Nil
do. do. "A"	Nil	Nil	6/-	—	Nil
do. do. Income	4	2	71¼	—	2 16 0
Foreign Trams, &c.	1918	1919			
Anglo-Arg. Trams, First Pref.	Nil	6½	2⅜	—	10 9
do. do. 2nd Pref.	Nil	Nil	8	—	Nil
do. do. 5 % Deb.	5	5	59½	—	8 8 0
Brazil Tractions	Nil	Nil	34	—½	Nil
British Columbia Elec. Rly. Pfcs.	5	5	55	—	9 1 10
do. do. Preferred	2½	5	84½	—	*3 14 0
do. do. Deferred	Nil	8	51½	—	*11 17 6
do. do. Deb.	4½	4½	88½	—	7 5 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	42	+2	Nil
do. 6 per cent. Bonds	Nil	Nil	23½	+1	Nil
Mexican Light Common	Nil	Nil	11¼	—	Nil
do. Pref.	Nil	Nil	18	—	Nil
do. 1st Bonds	Nil	Nil	68½	+1½	Nil
Manufacturing Companies.					
Babcock & Wilcox	15	15	2⅛	+ ⅛	6 0 0
British Aluminium Ord.	10	10	16/3	—	12 6 2
British Insulated Ord.	12½	15	1 5/16	—	9 12 0
Callenders	25	15	1⅛	+ 1/16	10 0 0
6½ Pref.	6½	6½	17/6	—	7 8 7
Crompton Ord.	10	10	15/-	—	13 6 8
Edison-Swan	10	10	12/-	—	—
do. do. 5 per cent. Deb.	5	5	70	—	7 2 10
Electric Construction	10	10	17/-	+9d.	11 15 4
English Electric	—	8	13/6xd	+6d.	11 17 0
Do. Pref.	—	6	14/-	—	8 11 6
Gen. Elec. Pref.	6½	6½	19/-	—	6 16 10
do. Ord.	10	10	24/6	—	*8 3 6
Henley	25	15	1 7/16	+ ⅛	10 8 8
do. 4½ Pref.	4½	4½	6⅛	—	6 18 6
India-Rubber	10	10	⅜	—	—
Met.-Vickers Pref.	—	8	11½xd	+ 1/16	9 9 8
Siemens Ord.	10	10	11xd	—	*8 17 10
Telegraph Con.	20	20	20	—	*5 19 9

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, May 3rd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	10d.	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	"	£65	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£34	..
a Copper Sulphate	"	£38	£1 dec.
a Potash, Chlorate	per lb.	6d.	..
a " Perchlorate	"	10d.	..
a Shellac	per cwt.	£16 10s.	50s. inc.
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers	"	£19	..
a " Lump	"	£18	..
a Soda, Chlorate	per lb.	5d.	..
a " Crystals	per ton	£7	..
a Sodium Bichromate, casks	per lb.	4d.	4d. dec.
METALS, &c.			
p Babbitt's Metal Ingots	per ton	£95 to £300	..
c Brass (rolled metal 2" to 12" basis)	per lb.	11½d.	..
c " Tubes (solid drawn)	"	1/1½ to 1/3	..
c " Wire, basis	"	11⅛d.	..
c Copper Tubes (solid drawn)	"	1/9½	..
c " Bars (best selected)	per ton	£116	..
c " Sheet	"	£116	..
c " Rod	"	£116	..
d " (Electrolytic) Bars	"	£78	£1 dec.
d " " Sheets	"	£145	..
d " " Wire Rods	"	£89	£1 dec.
d " " H.C. Wire	per lb.	11 7/16	½ dec.
f Ebonite Rod	"	3/6	..
f " Sheet	"	3/-	..
a German Silver Wire	"	2/9	..
h Gutta-percha, fine	"	14/- to 16/-	..
h India-rubber, Para fine	"	10½d.	½d. dec.
l Iron Pig (Cleveland Warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£40	..
g Lead, English Pig	"	£23 10s.	20s. inc.
g Mercury	per bot.	£11 5 to £11 10	25s. dec.
e Mica (in original cases) small	per lb.	4d. to 4/-	..
e " " " medium	"	5/- to 10/-	..
e " " " large	"	12/6 to 25/- & up	..
p Phosphor Bronze, plain castings	"	1/4 to 1/9	..
p " " rolled bars and rods	"	2/1 to 2/6	..
p " " rolled strip & sheet	"	2/2 to 2/7	..
d Silicium Bronze Wire	per lb.	1/9½	½d. dec.
r Steel, Magnet, in bars	"	1/5	..
n Tin, Block (English)	per ton	£166 to £167	£12 inc.
n " Wire, Nos. 1 to 16	per lb.	4/-	..
p White Anti-friction Metals	per ton	£78 to £300	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
n Richard Johnson & Nephew, Ltd.
p P. Ormiston & Sons.
r W. F. Dennis & Co.

German Factories in the Argentine. — The South American market is one which has claimed a considerable share of attention from Germany in her post-war trade activity. According to a F.B.I. correspondent, writing from the Argentine, a movement has been started for the establishment in that country of German factories, with a view to utilising the abundant raw materials available. As an instance which has recently come beneath his notice, he mentions the purchase by Herr Thyssen, the German industrial magnate, of an extensive factory site on the Riachuelo, comprising numerous large and well-built brick buildings, and possessing direct railway connection with all parts of the Republic. Efforts made to interest British capital in the site proved fruitless, though the German buyer is said to have made up his mind within twenty-four hours of inspecting the place. The Thyssen group has also, he states, bought one of the large engineering shops in Avellaneda.

A newspaper cutting forwarded by the correspondent announces that the Argentine Consul in Berlin has informed his Government of a proposal to transplant bodily various Saxon factories engaged in the manufacture of sacking for bags, together with a number of skilled workers. Experiments are at present in progress with raw material from Argentina, from which astonishingly good results are being obtained. Certain obstacles are, however, being placed in the way of the export of the necessary machinery by weavers of similar textiles in Germany. Another German firm proposes to install a factory in the Republic for the purification of oil obtained from Argentine linseed, and a technical personnel is being recruited under the direction of the industrial chemist, Dr. Reichau. The quality of the samples obtained by the process to be introduced leads the Argentine Consul to regard this as an important step in the development of native industries. The Federation's representative in Rio de Janeiro mentions in a recent letter a report that certain German syndicates propose the erection in Argentina of textile mills in areas where adequate water-power is available.—*Bulletin of the Federation of British Industries.*

THE INDUSTRIAL SITUATION IN SWEDEN.

As a growing manufacturing country—one of those non-belligerent countries which were compelled to develop their industrial resources owing to the exigencies of the war—Sweden claims a prominent position, and for this reason the report by Mr. H. Kershaw, Commercial Secretary to H.M. Legation at Stockholm, on the commercial and industrial situation of Sweden at the close of 1920, has been issued at an appropriate moment.

The report states, in its general review, that in the course of years many industries have been brought to a high standard of efficiency, including the manufacture of ball bearings, telephones, and many other electrical appliances. Though the war did nothing to retard the progress of these and other industries, the phenomenal advances in manufacturing and engineering accomplished through the force of circumstances in belligerent countries are said to make it incumbent upon Swedish engineers to exercise their maximum efforts in order to keep pace with the abnormally rapid developments which took place during the war. As to the high costs of production which prevailed in Sweden in the past two years, the report attributes this partly to the dearness of coal. When the latter rose to about 150 to 160 kr. per ton, manufacturers began to feel the injurious effects of the costs of production. As a result of these adverse factors many suggestions were made in responsible quarters to press forward the schemes for the more extensive utilisation of the waterfalls for the provision of electrical energy for lighting and power purposes on a commercial basis. Now, however, that the price of coal has fallen to about 70 kr. per ton, the report remarks that it remains to be seen whether these schemes will command the same enthusiasm. To this statement may be added the fact that owing to the situation of the State finances and the great expenditure now necessary for the establishment of hydro-electric works, the Hydro-Electric Department is restricting the amount of the extension work being carried out at existing works and in connection with proposed new hydro-electric works.

British and German Travellers in Sweden.—Coming to consider the problem of British trade with Sweden, the Commercial Secretary states that the time has arrived when British manufacturers and exporters must seriously consider the methods of conducting their agencies in Sweden. As he says, an enormous amount of trade has been, and is still, being lost to British manufacturers for no other reason than that many Swedish traders are placed in the position of being required to carry on their British import business through agents domiciled in other Scandinavian countries, which was originally due to the existence of well-established and strong financial houses in these other countries. These reasons, however, no longer hold good. During recent years there has arisen in Sweden a large number of very experienced import and export merchants whose business is well supported by the great banks, which lend their aid not only by credit advances, but also give daily advice on market and monetary conditions. It is true to say, therefore, that a feeling of resentment has gained ground in Sweden towards the prevailing custom, which often compels the Swedes to carry on British import trade through the medium of travellers from other parts of Scandinavia who visit the country periodically.

As a consequence of the rapid growth of harbour facilities at Gothenburg, Stockholm, and Malmo, together with the establishment of free ports and warehouses, supported by a rapidly increasing mercantile marine, a gradual and organic change is taking place in Sweden, so that in the course of time the country will have to be reckoned with seriously in merchant trading, whether directly with Sweden itself or indirectly with the States in the Baltic.

In emphasising the fact that the present is an appropriate time for taking the matter into consideration in all its bearings, the report says that German travellers are visiting the country in large numbers, and many applications are being received from German firms for agents in Sweden. British travellers are urged to discontinue the habit of confining their visits to a few of the large towns such as Stockholm, Gothenburg, Malmo, and Norrkoping, and missing, on the ground that it entails too much trouble, the considerable number of small towns where a very thriving business is to be done. At the same time, it is admitted that British travellers are now visiting Sweden in increasing numbers, although not to a sufficient extent, in view of the large amount of trade which is declared to await enterprising firms.

The Protection of Industries.—During the second half of the year, according to the report, perhaps the most important agitation ventilated publicly related to energetic demands on the part of industrial representatives for the imposition of import duties on those classes of manufactures which form some of the staple industries in Sweden. In order to understand the real meaning of this movement the report mentions that many industries originated during the war, and a number developed their operations and carried on a thriving business owing to the practical cessation of imports. Money was plentiful, and consequently prices reached a high level, and it was easy to carry on manufacturing owing to the almost complete absence of competition

A reversal of these factors, however, took place in 1920, and in consequence of the very low rate of German exchange, and in conflict with outside competition, many important Swedish industries were faced with serious problems, which were still more accentuated by the high scale of wages. Under the circumstances a comprehensive case for additional protection was submitted to the Government by the Federation of Swedish Industries. The principal industries affected are iron and steel, textiles, glass, boots and shoes, furniture, and certain branches of the electrical industry.

In spite of the strong case put forward by the representative associations, both the Swedish Board of Trade and the Economic Council, which were invited to express an opinion on the question, decided against an all-round raising of the Customs duties and import prohibitions. The utmost they found it possible to recommend, compatible with the general economic conditions, was the imposition of provisional increases in the duties in isolation cases where very urgent reasons existed in connection with certain distressed industries which it was in the national interest to maintain. The report states that the answer of the authorities to these requests for vigorous protective measures—suggested trebling of the import duties—is not surprising.

It is, however, important to note that the Government had not given an answer by the end of last year, and has not done so down to the present time. What the Government did, after hearing the views of the Swedish Board of Trade, which by no means is the equivalent of the English Board of Trade, was to appoint a committee to consider the whole question. The committee held various meetings, and then held conferences with the representatives of various industries which it is necessary to maintain in the national interest, subsequently settling down to the drawing up of their conclusions, which were published by the Ministry for Commerce at the beginning of April of the present year. There is no report; the members of the committee have merely stated their individual views; three members are against any increase in the duties, while the others are divided as between a partial and a general increase in the duties. Now the Government has to determine its attitude on the problem or, in other words, to give its answer to the petitioning industries.

Dealing with industry and trade in detail, the report remarks that the national industries had to face considerable difficulties during the year. Manufacturers not only had to fight competition, but at the same time they were unable to obtain capital or realise funds at a time of considerable stress owing to the stringent credit conditions and the shortage of money. On the one hand, the importation of large quantities of goods from Germany and from other countries also having a depreciated currency naturally reduced very largely the market for Swedish goods; and on the other, it was impossible to reduce the enhanced costs of production owing to the high rates of wages and the operation of the eight-hour day.

Iron and Steel.—Leaving on one side timber and wood pulp and paper, the report approaches the iron and steel industry, which is stated to have experienced a temporary improvement in the early months of the year, but the production is still far below the average output in previous normal years. As statistics of production and of the number of blast furnaces and steel furnaces in operation have already been issued by the Swedish Iron and Steel Association for the whole of last year, it is unnecessary to refer to the figures given in the report for the first nine months of 1920.

On the whole, iron and steel manufacturers were able to maintain their position in the export markets surprisingly well, but considerable difficulty was experienced in the home market, owing to the large imports of semi-finished and of manufactured iron and steel products, of which steel rails represented a large proportion. Generally speaking, the iron and steel industry at present is in a difficult situation, and many works have been compelled, in order to keep in operation, to sell at prices almost below the costs of production. The two factors of decreasing demand and falling sale prices, together with the severe competition from Germany, are the causes of the existing state of affairs; and it was for these reasons that the Iron and Steel Association made urgent representations for the introduction of protective measures.

Electric Traction and Wireless Stations.—After dealing with the textile and other industries, the report proceeds to refer to the State railways. It is mentioned that a Bill was introduced into Parliament asking for the allocation of 26,000,000 kr. out of the 1922 funds as an instalment towards the electrification of the railway between Stockholm and Gothenburg, the total expenditure of which is estimated at 75,000,000 kr. In this connection it is stated that a number of electric locomotives has already been ordered by the State railway authorities. Similar assertions were made some time ago in the Swedish newspapers, but no firm has hitherto admitted having received the order. The accuracy of the statement is, moreover, questioned by the fact that, as the report says, "there is some doubt at present as to whether the direct current or the single phase, alternating current system should be adopted. The alternating current system had been previously decided upon, but the head engineers

now appear disposed to alter their opinion." It is, however, not mentioned that the change of opinion is due to the knowledge gained by the Swedish State railway engineers of the working of the direct current system in the United States on the occasion of the visit which they paid to that country some months ago.

Wireless telegraphy follows shipping, shipbuilding, free ports, and warehouses, and the suggested train ferry between Sweden and England. The chief public stations are at Vaxholm, Karlskrona, Tingstade, and Gothenburg. An attempt to establish wireless communication (spark system) between Sweden and Italy was made in the night of August 26th-27th, 1920. The experiment was completely successful, and messages were exchanged directly between the Swedish station at Karlborg and the San Paulo station in Rome. A proposal is now under consideration for the construction of a new high power station at Falkenberg on the West Coast, for direct communication with America, which is expected to be one of the largest stations in the world.

Water Power and Electrification.—The electrical manufacturing industry is entirely ignored by the report, but under the heading of water power and electrification—the latter term is used by the Swedes also to designate electric supply schemes for agricultural districts—it is stated to be estimated that the available water power at "industrial mean water" (about nine months of the year) totals 6,700,000 h.p., the development of which has seriously engaged the attention of the Government and of manufacturers during the past few years. The difficulty experienced in procuring coal and the very high prices which had to be paid for this fuel have created an enormous incentive to progress in electrification schemes.

Another important aspect is the electrochemical industry, which is growing year by year. The industry already exports considerable quantities of calcium carbide, nitrolime, chlorates and perchlorates, sulphate of sodium, and chloride of lime; and among electrometallurgical products are mentioned electro pig iron, electro steel, ferro-silicon, ferro-manganese, zinc, and lead.

Some of the largest power stations are at Trollhattan, which is equipped with 15 turbo-generators, each of 11,500 h.p. and developing a total of 104,000 kW. The large station at Porjus is built underground as a protection against frost, and the power is distributed to the Kiruna and Malmsberg mines of the Grangesberg Co., and is also employed for the working of the electric railway between Gellivare and the Riksgransen (Norwegian frontier).

At present only about 30 per cent. of the cultivated area of Sweden is electrified, and with a view to increasing the number of power stations the Government granted to the "Electric Power Construction Loan Fund" the sum of 3,500,000 kr. in 1918-19, but it appears that the applications for loans received by the administrators of the fund exceeded 17,000,000 kr. The Government made a further grant of 2,500,000 kr. to the fund in 1920, and a still further amount of 1,500,000 kr. has been earmarked for 1921. The authorities are petitioning for larger grants inasmuch as it has not been possible down to the present to grant more than one-third of the applications under the scheme.

The total production of energy at the State power stations in 1920 amounted to 740,000,000 kWh, as compared with 685,000,000 kWh in the previous year; and the total income derived from all the generating stations was 15,070,000 kr. last year, as contrasted with 12,370,000 kr. in 1919.

A discussion of labour and social questions, statistics of imports and exports, &c., bring the report to a conclusion.

MAGNETOS FOR INTERNAL-COMBUSTION ENGINES.

By A. E. WATSON, A.M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

The function of a magneto is to supply at perfectly regular intervals a sudden electrical impulse in the form of a spark between a pair of points in the engine cylinder usually about 0.5 mm. apart which are, at the moment when the spark is required, surrounded by gas at a pressure which may reach as high as 6 or 7 atmospheres. It is agreed that, with any of the gaseous mixtures met with in practice, provided a spark is produced between the plug points, ignition is bound to occur.

The characteristics of sparking plugs indicate that, in order to ensure satisfactory starting, the magneto must give a peak voltage of 10,000 volts when the engine is turned by hand or by the electric starter. This speed may be taken as being approximately 100 r.p.m. on the engine in the case of motor cars of small and moderate sizes. It is much less in the case of lorry and tractor engines where self-starters are not fitted.

Typical speed/voltage curves are shown in fig. 1. The upper limit of speed is very rarely encountered, except in the case of aeroplane engines, when with some cylinder arrangements the normal speed of a two-spark magneto may be 2½ times engine speed. The conditions as regards voltage required are usually less severe in such a case than at low speeds, as the temperature is considerably higher, and at extreme speeds the gas pressure in the cylinders is reduced, due to throttling in the induction system. A figure of 8,000 volts is certainly an outside one, even for high-compression engines with well-designed induction systems, and 5,000 to 6,000 volts is a more usual figure. On the other hand, adverse conditions due to plug leakage are generally more likely to occur at high speeds than at low ones.

Adverse conditions due to leakage may be due to various causes, all but one of which are effective at starting when everything is cold and when the magneto running slowly produces a comparatively feeble spark. Leakage through the body of the insulator of the plug itself is generally only evident when the insulation of the plug has been heated. Some porcelains show a well-marked leakage at quite low temperatures, but mica shows practically nothing up to 500 deg. C. With satisfactory sparking plugs a temperature sufficient to render the insulation conducting will certainly be sufficient to cause trouble to develop through pre-ignition, before any failure would arise due to electrical leakage. The spark discharge consists of two portions, first a capacity spark in which the energy stored in the capacity of the leads, terminals, &c., discharges practically instantaneously across the gap, and following upon this a flame-like spark or arc, the duration of which is controlled by the electrical constants of the machine. The total energy in the discharge does not strictly represent the capability of a magneto for dealing with a leaky circuit. Clearly this is more a function of the maximum current which the magneto can supply than of the total spark energy, the condition being that the machine shall furnish the leakage current of the system at the same time that it charges all the terminal capacity up to the sparking voltage. A machine giving a small current lasting for a long time will be much less suitable for this purpose than one giving a heavy current for a shorter period, even though the total energy may be greater.

Direct measurement of the current which the magneto can yield is difficult. The simplest and most satisfactory method of comparing different machines is by shunting their terminals with a high resistance in parallel with a spark-gap. The value of the resistance necessary to stop sparking is then employed as a criterion of the capability of the machine for dealing with a leaky circuit. Such a test is generally called a "utility test," and the resistance required to quench the spark is the "utility" of the magneto.

Fig. 2 gives a series of utility figures obtained on various types of magnetos, the majority of which gave satisfactory service, showing that in many cases the machine had a very large margin to spare over what was actually required of it. The

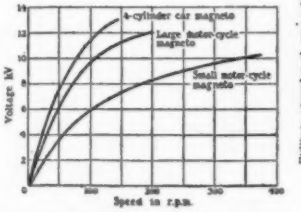


Fig. 1.—Performance of Various Magnetos at Low Speeds.

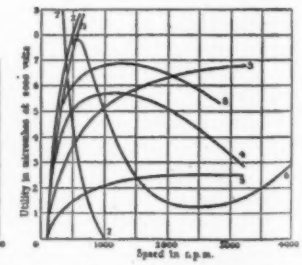


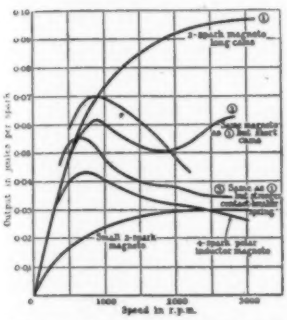
Fig. 2.—Comparative Utility Curves.

machine shown in curve 6 actually did give trouble in service, due to a defect in the design, which was overcome, and the machine then gave the results shown on curve 1, after which no further trouble was experienced. Curve 7 is for a battery ignition set and is just the reverse of that given by the magnetos. Battery sets are always good starters, but usually fail to function at very high engine speeds, unless very great care is taken in their design. At the present time there is no generally accepted standard of utility which a magneto must fulfil, but the author's firm has adopted the figure of 4 micromhos, and no case has yet been observed of a machine which passes this test giving trouble on an engine.

The principles of operation of a magneto are next dealt with, and the cycle of operations accompanying each spark is considered in successive steps which may be divided into: (1) storage of energy in the magnetic field, and (2) the collapse of that field and the transference of the energy to the secondary circuit. The relation between the properties and the dimensions of the magnets and the energy which can be stored in the magnetic field are considered in detail, attention being drawn

to the importance of the shape of the B H loop and its effect upon the energy which can be stored. It is shown that the most important property of the magnet is the maximum value of B H and that the value of B H and the curve connecting B H and H are, therefore, important criteria in the choice of a permanent magnet.

Until a year ago the range of magnetic properties of available steels was somewhat restricted. Great use is made in America of chromium steels which, although not quite equal to tungsten, give results considerably better than the plain carbon steels. A good chromium steel magnet will give a $(B\ H)_{max.}$ of from 240,000 to 250,000, against a corresponding figure for tungsten of from 280,000 to 300,000, while a plain carbon steel will not usually exceed 200,000. These steels were also used in Germany during the war, when tungsten was unobtainable in that country. During the last 12 months, however, the range of steels available has been enormously extended by the introduction of the new cobalt steels. From these steels, which con-


Output in watts per watt
Speed in r.p.m.
2-spark magneto using cams
Same magneto as ① but Short Cams
③ Same as ① but strong contact-breaker spring
Small 2-spark magneto
4-spark pole inductor magneto

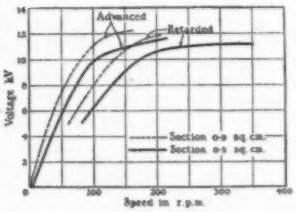


Fig. 3.—Typical Magneto Spark Energy Curves. Fig. 4.—Effect of two Different Sizes of Copper Cross-section in Primary Winding. Extended Pole-tips.

tain cobalt alloyed with iron in various proportions in addition to other elements such as tungsten, chromium, &c., a very wide range of figures can be obtained. With 35 per cent. of cobalt, values of $(B\ H)_{max.}$ as high as 900,000 can be reached, the value of $B_{rem.}$ being from 10,000 to 10,500 with a value of H_c of about 200 to 240. Such a steel is expensive owing to the high price of cobalt, but a very much smaller amount of it is required, and the higher coercive force opens up great possibilities in the way of simplification of design, owing to the reduction in magnet length permitting straight bars to be used in place of the horseshoe magnets hitherto employed. These steels have not yet been available for a sufficient length of time to allow their influence on design to become apparent, but there is little doubt that they will lead to very considerable developments during the next few years. The utility of the machine is by no means proportionate to the energy output, and the present trend of design is to maintain or to increase the utility while reducing the energy output. Hence the size of magnets provided in machines of a given performance has been considerably reduced.

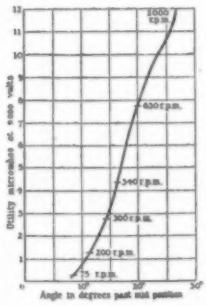
A condition to be fulfilled by the design is that the removal of the armature shall not take the magnet appreciably beyond the point of $(B\ H)_{max.}$ This gives a relation between the gap between the poles of a magnet, the magnetic constants of the material, and the length of the magnet employed. As the magnetic constants will vary with the material employed, it is useful to express the proportions of the magnet in terms of the magnetic potential between its extremities. This is zero when the magnet is short-circuited, and should never exceed the value corresponding to the optimum value of B H. The value of this quantity ranges from about 600 for very small motor-cycle magnetos, to 1,200 for machines intended for lorry and similar work. Ordinary tungsten steels have the optimum value of B H at about H=40, corresponding to a length of from 15 to 30 cm.

The general effect of both armature and air-gap reluctance is to reduce the available amount of stored energy; both must, therefore, be reduced to the least value possible. The air-gap is generally about 0.1 to 0.15 mm. measured radially. The universal employment of ball-bearings for the armature spindle facilitates the maintenance of such a small gap. The armature reluctance can be kept low by using material of high permeability and taking care not to work at too high a density, but if the density chosen is too low the size of the core and the length of the primary winding are increased, thus reducing the constraint of the primary winding upon the flux, and reducing the amount of flux distortion at low speeds. The usual density in most machines is from 12,000 to 15,000 lines per sq. cm., and the corresponding magnetic potential between the pole-faces when the armature is in its zero position is approximately 100 C.G.S. units, or, say, from 8 to 16 per cent. of the value corresponding to storage of maximum energy.

The effect of armature resistance has a very important bearing upon the operation of the machine, more especially at low speeds. The effect of the primary resistance is to cause a flux-change to occur in the armature core as it rotates in the act of distorting the field, inducing in the primary winding a small e.m.f. which maintains the current producing the distortion. The e.m.f. necessary for a given flux distortion will be independent of the speed and of the time elapsed since the beginning of the cycle and so will, therefore, be the rate of the flux-change. Consequently, for low speeds of rotation and long cycles the total flux-change will be very much less than for short ones, so that the flux actually distorted at the point of break will diminish as the speed is reduced, and there will be a corresponding diminution in the stored energy. Consequently the spark energy will rise as the speed increases up to a maximum value at which the amount of flux leaking back is small compared with the total. This maximum value is generally obtained at about 2,000 r.p.m. and is clearly shown in fig. 3. To get the best performances at low speeds without any sacrifice in other directions, the cross-sections of the primary winding must be as great as possible and its length of mean turn a minimum. It is impossible to design a machine which will give a good performance at low speeds over a large angle and will still give ample spark energy in all positions at high speeds without exceeding the optimum value of B H for the magnet.

Machines employing a separate transformer have an important advantage in that the whole of the space on the armature can be filled with short-circuited winding. Fig. 4 shows the way in which the performance of a magneto at low speeds varies with changes in the copper cross-section of the primary winding, and also with the shape of the pole-shoes; the pole-shoes have been extended so as to give a more uniform performance. Fig. 5 shows the way in which the position of maximum utility varies with the speed and angular position of the armature. To obtain a variable point of ignition, a better arrangement on theoretical grounds is to fix the position of the armature with relation to the pole-shoes at which the spark occurs, and obtain any necessary variations in timing by altering the angular relation of the magneto to the engine, which may be done by several forms of special coupling.

Having traced the storage of energy in the stretched magnetic field, the author considers the transformation of this energy into that represented by a current flowing in the high-pressure circuit. In an actual machine the presence of eddy currents in the armature core and pole-shoes retards the movement of the flux and, therefore, lessens the secondary voltage which a given flux-change can produce. Further, the primary and secondary windings, each with its own associated capacity, form a pair of coupled circuits which interact. It is important to make the necessary flux-change as small as possible, for it is upon this that the performance of the machine at low speeds primarily depends. The most obvious point calling for attention is the correct lamination of the magnetic circuit. It has always been the practice to laminate the armature core carefully, and now the majority of British firms and one or two American ones are fitting laminated pole-shoes. Fig. 6 gives comparative tests made on the same machine with



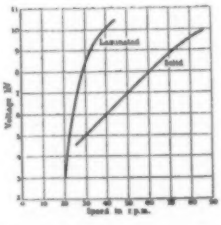


Fig. 5.—Variation in Position of Max. Utility with Speed. Fig. 6.—Comparative Tests on Machine with Solid and Laminated Pole Shoes.

solid and laminated pole-shoes, and shows clearly the advantage derived from the latter. By adopting the laminated construction a saving in weight of from 25 to 30 per cent. can generally be effected without any deterioration in performance.

The condenser may be regarded as a device for suppressing sparking at the contact-breaker points, and as forming one element of an oscillatory circuit inductively coupled with the secondary. In practice the rupture of the primary circuit can never be instantaneous, and there is a definite relation between the sparking voltage between the two points and the time that has elapsed since they commenced to separate. The rate of pressure-rise and maximum voltage developed appear to be independent of the cam shape, so that the mechanical conditions of break do not appear to be of great importance. A voltage of about 350 volts appears to be necessary for a gap of 0.1 mm., rising somewhat as the gap is reduced to 0.001 mm., and then falling again. On this basis, provided the voltage had not attained a higher figure than 350 volts during the first 0.001 mm. travel of the points, sparking would not occur, whereas it is found that the capacity must be much more than corresponds to this rate of rise in order to suppress sparking.

(To be concluded.)

THE INDUSTRIAL APPLICATION OF VARIABLE-SPEED MOTORS.

By Dr. S. PARKER SMITH.

(*Abstract of lecture delivered at the* Western Centre *of the* Institution of Electrical Engineers.)

The forty-first ordinary meeting of the Western Centre of the Institution of Electrical Engineers was held at Swansea on April 4th, when a large audience assembled to hear Dr. S. Parker Smith lecture on "The Industrial Application of Variable-Speed Motors."

The Lecturer approached the subject from the point of view of the designer, and in the course of a comprehensive and interesting discourse, stated that series-parallel sets were economical but expensive; resistance control was suitable only for starting, and was very uneconomical, but field control was simple and economical. In Creedy's ingenious device the number of poles was changed by changing the number of phases. The lecturer deplored the lack of encouragement given to British manufacturers in their endeavour to produce variable speed motors—they were almost driven abroad to get a suitable number of steps in speed. He desired British firms to lead not to follow. A.c. commutating motors were almost solely built by Continental firms, and the British Thomson-Houston Co. was practically the only firm in this country supplying that type of machine. It would be very misleading to say that those motors could be built for any desired power and speed range. The three-phase commutator was the latest production in electrical engineering, but it had more limitations than the one-phase commutating motor. The chief limitation was that due to the pulsating flux. With the d.c. motor two speeds were obtained with series-parallel control, and speed was increased slightly by weakening the field. In the a.c. one-phase motor six speeds were obtained with no trouble at all. It was more difficult to overcome the pulsating flux in the three-phase than in the one-phase machine. A perfectly satisfactory job was made from about zero to four times synchronous speed. It was perfectly satisfactory for all continental railways with the exception of French ones, which preferred to use d.c.; in Italy three-phase was used. By imposing cascade commutating motors on induction motors not only were all the characteristics obtained that were obtained with d.c. commutating motors, but a wider range of speed control was obtained by varying the voltage —that applied to motors with series characteristics. Some years ago a paper was read before the Institution of Civil Engineers by Mr. Ll. B. Atkinson, in which means were shown of obtaining a shunt characteristic with an a.c. commutator, and also means for varying the speed. Mr. Atkinson's methods had been developed, not in this country but in Germany. In future there would be demands for speed control without converting to d.c., but the devices must be simple. Co-operation between the user and the maker was absolutely necessary—it was not the policy of makers to build machines for orders as an experiment unless it was done by agreement; makers should be encouraged to build experimental machines in conjunction with the users, and a cordial and friendly arrangement should be made that a certain system would be tried for obtaining a desired result. He considered if that were done there would not be nearly the trouble and difficulty experienced in the past. Where a hard and fast specification was given it was usually accompanied by stringent guarantees, which were probably necessary under past conditions, but which tended to kill experimental work. If they were to develop on the lines suggested and to lead instead of follow, they must have co-operation in that direction.

Principal Sibley (Swansea University) urged that the Institution might allow more than one meeting a session at Swansea, and also alluded to the engineering course at the Swansea College and the lectures which were to be given by Mr. J. W. Burr, the borough electrical engineer of Swansea.

Prof. Bacon (Swansea College) commented on the fact that the lecturer was a man who had the courage of his convictions. It was good to know that a man of his calibre was in charge of heavy engineering at South Kensington. He agreed with Dr. Smith's opening remark that the life of the Institution was in its provincial Centres, and those Centres served up a much more appetising bill of fare than that obtainable in London.

Mr. J. W. Burr (Swansea) explained that he had offered to lecture to the Swansea University. Municipal supply engineers realised that induction and synchronous motors were not suitable for all purposes; they also realised that it was necessary in most places to install rotary converters, &c. Supply authorities had no objection to a man wasting "juice" if he wanted to. With regard to power factor, that was a point which all station engineers had to tackle. They realised that consumers taking current at 0.6 power factor were in effect using a 1,000-kW generator to give 600 kW, and to adjust them 400 kW had to be added to capital charges; that not only applied to generation, but also to transformation, distribution, and transmission losses, and it behoved them as engineers to improve their power factor.

Mr. A. Ellis (Cardiff) said he could lay claim to being one of three of Sir Charles Parsons's first pupils, and had Sir Charles given up hope of developing his turbine as the British manufacturer had given up the variable speed motor, the electrical and the shipping industries would not have been in the position they occupied to-day. He agreed with Dr. Smith that instead of leading they were following, and thought it very desirable that supply engineers should extend to manufacturers that co-operation which was necessary to bring about desired results.

Prof. Isaacs pointed out that the induction motor had many advantages of which the absence of a commutator was held to be the greatest. It was a fact that to-day many mills were being driven at uneconomic speeds because induction motors were installed. Dr. Smith had shown them the way to get over that difficulty. He indicated that they were on the wrong track, and that the development of the polyphase commutator motor must be improved. There was a scarcity of literature in England on that matter, and at scarcely any university would be found an example of a polyphase commutator motor. Perhaps the representatives of manufacturers would bear those points in mind.

Mr. Jenkins (Metropolitan-Vickers Co.) said that the commutator motor at first sight appeared very simple. In connection with the lecturer's remarks that German manufacturers were more ready to develop than British manufacturers, it should be recalled why they were able to do that. In Germany there were practically only three manufacturing companies; prices were fixed, and nothing was sold under a fixed minimum, and in that way prices of plant in Germany were kept up to a level to enable them to develop at home and take the export markets. Considerable assistance was derived by manufacturers from industrial banks, and before the English manufacturer could develop similarly, he must have corresponding facilities; he considered the time was ripe for such a policy to be considered by Great Britain. The lecturer had inferentially stated that the German was a super-engineer. His (Mr. Jenkins's) experience was different. He considered the plant turned out by the A.E.G. in no way compared with similar plant turned out by English firms.

Mr. Smith (Student, Swansea University) was very glad to have the opportunity of saying how much students appreciated this form of lecture. It was of very special value inasmuch as Dr. Smith had treated the broad aspect of the subject.

Dr. S. P. Smith, in reply, said he would like to remove the rather wrong impression he might have given that he was "cracking up" German engineers. He did not think any firm had done better than the Oerlikon in building the variable-speed motor, and he believed that was a genuine Swiss firm. Where Germans had beaten them was in theory, not in practice. If the larger engineering interests would only pay more attention to developing and look ahead, the user would go on increasing his demand; 1,500 volts had been adopted for the electrification of railways in Great Britain. Supposing single-phase had been advocated, to which firm would they have turned in this country for the single-phase equipment? When the Swiss decided to continue with single phase, what they said was: "We are accustomed to single phase, our manufacturers are accustomed to it." Therefore, they decided without hesitation on the single-phase system. Had the reverse been the case, they would have gone out of the country for their electrical equipment. Much as he disliked flywheel sets, he had to regard them at the moment as makeshifts, and he hoped that opinion would prove true; he hoped the day would come when they would manage without flywheel sets. Tremendous advance had been made in foreign countries, and in Switzerland the valley stations were linked up with the hill stations. They should forge ahead with the electrification of railways; the present methods, however, were too cumbersome.

The Chairman (Mr. A. J. Newman, Bristol) said that the suggestion of having two meetings in Swansea would be considered by the committee, but funds did not go so far as they once used to. The Western Centre had a fairly ambitious programme, and although the area was extensive it was at the same time sparse. There were no nuclei outside Bristol, Cardiff, and Swansea, but the committee would give every consideration to the wishes expressed.

Dutch Manufacturing Conditions.—The report for 1920 of the N. V. Hazemeijer, of Hengelo, Holland, states that the difficulties of obtaining raw materials arising from the war gradually disappeared in 1920, and it was possible to increase manufacturing to a level corresponding with requirements. At the end of the year the general depression caused a decline in the orders coming to hand, although the new year started with a good stock of orders on hand. During the first quarter of 1921 the value of the deliveries was greater than in the equivalent period in 1920, but the amount of new business booked showed a diminution. Foreign competition was being experienced, and on the other hand customers were only buying for immediate requirements. The net profits earned in 1920 amounted to 129,000 florins, permitting of the payment of a dividend at the rate of 11 per cent. on the ordinary shares and 6½ per cent. on the cumulative preference shares.

THE UNDERGROUND RAILWAY TRAINING SCHOOL.

Until about 14 months ago new members of the staff of the London underground electric railways were trained under the tuition of individual instructors, but the system proved to be not all that might be desired. A school was, therefore, brought into being for the purpose of centralising the engagement of all new staff for the traffic departments of the various railways, and to provide demonstration equipment for the training of the staff.

The school, an opportunity to visit which presented itself last week, through the instrumentality of the London Electric Railway Co., was opened on February 4th, 1920, and is located at the Lambeth (North) station on the Bakerloo Railway, the accommodation provided comprising office facilities for the principal, a lecture room, booking office school, motor equipment room, medical officer's room, and a kinema hall, all fully equipped.

The accompanying illustrations are two views of the interior of the motor equipment room wherein is installed a complete full-size motor car equipment of the type used on the District Railway. Full electrical and air pressures are

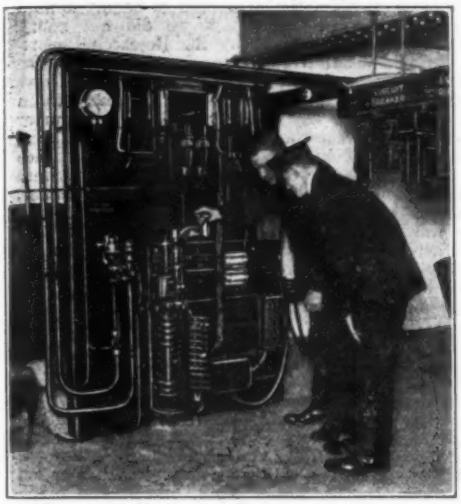


Fig. 1.—Motormen's Class Room, Showing Control Board.

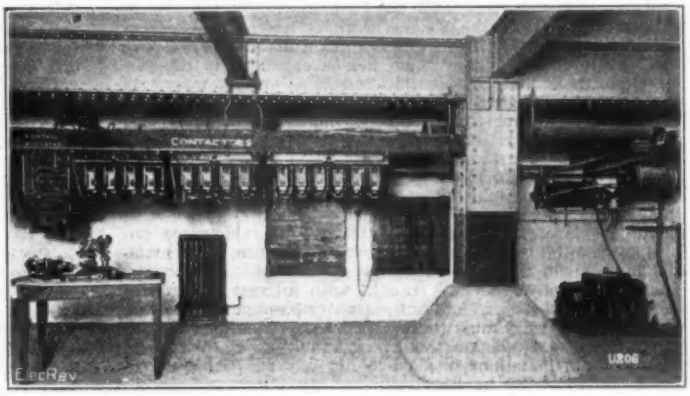


Fig. 2.—Motormen's Class Room, Showing Contactors and Brake Equipment.

available, so that the pupil is able to stand in front of the control board (fig. 1), which represents the inferior of a train driver's cab, and by manipulating the power and brake levers he is able to follow the sequence of operation of the circuit breaker, control rheostat, contactors (fig. 2), power rheostats, motors, &c., as well as that of the air valves and compressor of the Westinghouse brake equipment, which is shown on the right-hand side of fig. 2.

With regard to the system of instruction, new men are instructed in the duties of booking clerks and porters, which are the preliminary grades, and in this portion of the training period is included the study of the history and "geography" of the railways, the avoidance of accidents, and the absolute necessity for courtesy on all occasions. It is of interest to note that the kinematograph is found to be a very valuable means of teaching the avoidance of accidents, and especially of demonstrating the right and wrong ways of doing things.

Before promotion to the higher grades of gatemen, collectors and liftmen, guards and signalmen, and motormen, men who have previously passed out of the school as proficient in the preliminary grades return for further instruction, which embraces lectures and the display of kinema films. Classes are also held twice a week which are open to all grades of men in the service for the improvement of their general knowledge of matters connected with the working of the railways.

After having completed their period of training the men are examined, and, if found proficient, a certificate is issued. This certificate must be obtained before they are allowed to take up the duty for which they have been trained. Moreover, in addition to the theoretical instruction the men are sent out on the line for a period of practical training under the guidance of a competent instructor.

All employés newly appointed to the service are required to undergo a medical examination by the companies' medical ledge of matters connected with the working of the railways.

During the first year of the school's existence, *i.e.*, February, 1920, to February, 1921, 257 new members of the staff were engaged, whilst 433 men of various grades passed through the school for instruction, and 320 medical examinations were made in respect of new staff and promotions to higher grades. It is pleasing to note that the men show no objection to attend the school; they are keen to attain the higher grades, especially the grade of motorman, because apart from the higher pay which the position carries, drivers do not have to come in contact with the travelling public.

THE INSTITUTE OF PHYSICS.

Inaugural Meeting.

The inaugural meeting of the recently-formed Institute of Physics was held in the Hall of the Institution of Civil Engineers on April 27th. Sir Richard Glazebrook, K.C.B., F.R.S. (president), who occupied the chair, briefly outlined the history of the movement for the formation of an institute for physicists, and thanked those who had given so much time to the institute, which had commenced with every expectation of success. Sir Richard then dwelt upon the aims and objects of the organisation which, briefly, were to bring together workers in the field of physics, both as regards pure research and industrial applications, and to raise the intellectual status of the profession by the grant of diplomas to fully-qualified physicists.

Sir J. J. Thomson, O.M., F.R.S., then spoke. He said his informal remarks would not deserve the title of "address"—the term used by the president. He welcomed the formation of the Institute, and said that already 300 members had joined, but the total membership would soon reach thousands. He had always been surprised that chemistry—really a branch of physics—should have an institute of its own, while there was no Institute of Physics. Referring to the place of physics in modern industry, the speaker said that, although he had been a student of physics for 50 years, his acquaintance with industrial physics had been purely accidental. Fifty years ago physical laboratories were few and sparsely populated. To-day they were many, but crowded. Then, physics was an army with many good generals, but very few "troops." At the present time physics offered a means of livelihood to every competent man, but the chances of making a fortune were very remote. In the early days the study of physics was its own reward. Now research had secured a firm position in industry, there were many endowed institutions, and several large firms had their own research departments. Apart from research there was a pressing need for the skilled supervision of the physicist in the processes of production. There was a certain widely-used British article which, made by hand and by old-fashioned methods, was far superior to the German model. When "mass production" methods were employed in its manufacture the quality fell considerably, and it was rendered inferior to the German article. Here was a task for a qualified physicist. The modern demand for physicists was far in excess of the supply. The proportion of university graduates who took honours in science was really small. An extra year spent in research was necessary, but in many cases this was beyond the students' means. This extra year brought a man from intellectual "adolescence" to "manhood," and gave independence of thought. Fortunately grants were now available to aid students in research, and although he had had, in the course of his duties, much experience of boards for the award of scholarships and fellowships, he had never met a more sympathetic body than the Research Grants Committee. The importance of research could not be over-estimated; it was as much a function of a university as education. Thanks were due to the Government for its aid in this direction, as well as to many private individuals. The growth of the science of physics in the last 50 years had been wonderful. He calculated that about 400 physical papers had been published in 1873. In 1920 the number had risen to 2,700—rather a terrifying prospect for those who wished to keep abreast of the science.

While talking about research, Sir Joseph urged his audience not to confine it to industry alone, but to foster research for research's sake. Many scholarships had been awarded for research in a very abstract science, that of pure mathematics. In conclusion, he congratulated the Institute, and hoped that it would prove of great assistance to industry and intellectual development.

Sir William Bragg, in proposing a vote of thanks to Sir J. J. Thomson, which was accorded with enthusiasm, said that Sir Joseph himself was an institution in physics, and they were thankful to him for his encouragement and advice.

The chairman then called upon the Rt. Hon. A. J. Balfour, O.M., F.R.S., who was present to welcome the Institute.

Mr. Balfour said that when Sir Richard Glazebrook had asked him to be present at that meeting, and when he had learned of the formation of an Institute of Physics, he was surprised that not until 1920 had such an institution been inaugurated. This country was behind no other in the study of physical science. As president of the Department of Scientific and Industrial Research, he knew of the valuable work done for the industries of the country by physicists. The outside public did not know; they seldom did know about those things which concerned them most. He referred to the industrial disputes which were oppressing the nation, and said that the energy involved should be employed in the conquest of nature—in producing more from natural resources—instead of in quarrels over the distribution of the very small proceeds of our present knowledge. All his life he had been interested in physics, and his mind went back to his Cambridge days when he came into contact with such men as Kelvin, Maxwell, Rayleigh, and J. J. Thomson. These were geniuses, and such men could not be produced by any system of education. Nevertheless the work of lesser men was of great utility, if not to make epoch-making discoveries, to pave the way to these. Money could not be expended in a better direction than that of scientific research, and it was with the greatest reluctance that the Treasury had been compelled to restrict grants for this purpose owing to the impoverished state of the country. Cambridge University, of which he was Chancellor, had led the way in science and urgently required pecuniary assistance. He was surprised that the imagination of some of our financial magnates had not been fired with the thought that any assistance they could give would be of benefit to the whole of civilisation; perhaps they desired to see immediate results, but these were of rare occurrence. The material idea would have to give place to the intellectual view. The work of physicists was fraught with interest and advantage to all, and if only for that reason the inauguration of an Institute of Physics must be regarded as a red-letter day.

Sir Robert Hadfield (treasurer), in proposing a vote of thanks to Mr. Balfour, said that his remarks had been of great interest, and he hoped that the result would be an influx of new members.

THE USE OF X-RAYS FOR TESTING MATERIALS.

In his third Cantor lecture at the Royal Society of Arts, on March 21st, Major G. W. C. Kaye dealt with the practical Application of X-rays to the testing of materials. The lecturer said that the great merit of this method was that it enabled a much clearer idea of the properties of materials to be obtained without damaging the specimen in any way. Furthermore, it provided in some cases the only means of detecting concealed defects in the material without sacrificing any part of the structure, and also of ascertaining the accuracy of assembly of component parts of structures. The present practical application of X-rays to the investigation of materials had reached a point where it was possible to examine lead to a thickness of 4 or 5 mm., tin to the extent of 12 mm., carbon steel or iron to the extent of 7.5 cm., aluminium and its alloys from 12 to 15 cm., and wood from 20 to 40 cm. It was difficult, however, to lay down figures of penetration into materials precisely, because progress was so rapid that they might be doubled next week. The limiting factors were the length of exposure and voltage, and it was possible now, for example, to get a photograph through an inch of steel in rather less than a minute, using 130,000 volts with a few milliamperes through the Coolidge tube. Within the thicknesses he had mentioned it was possible, with considerable accuracy, to hunt out anything of a foreign nature in the material being investigated, and even to detect the finest tool marks and thin mould marks. Different densities in the materials displayed different densities in the radiographs. For example, a rivet would show darker than the material in which it was placed, whilst carbon, nickel, and tungsten steels differed very little in transparency.

One promising outlet for the X-ray method of testing was in connection with welding. Electric and oxy-acetylene welding had come into great prominence during the war, and an indifferent welder could turn out large numbers of welds which appeared to be first class, but which in practice had proved to be quite unreliable. There was no adequate mechanical test for a weld, and in any case, such a test, whether mechanical or microscopical, destroyed the weld, good or bad. When an X-ray photograph was taken of a weld, the presence of a shallow line indicated that the two parts were not truly joined together throughout the whole of the depth. Blisters and blowholes showed up as light spots, and were the sign in many cases of overheating. The examination by X-ray photography of welds up to 1 in. in thickness was now quick, easy, and certain, and with modern equipment lengths up to 2 ft. or more could be investigated at once, the exposures taking a fraction of a second. The amount of detail revealed in the photographs was extraordinarily good, and compared favourably with photo-metallography, which only tested a tiny bit of the weld and involved its destruction. The lecturer thought the X-ray method for testing welds had not made the progress it deserved, perhaps because it was a somewhat severe critic of present-day welding. Again, X-ray investigation promised to be exceedingly useful for the detection of hidden cracks, which were the great bugbear of metallurgists. Such cracks were often the sequel to pipes or blowholes in the original ingot. In the case of alloys the uneven distribution of the component parts resulted in a streaky or patchy negative. Also X-ray examination often would diagnose defective soldering or brazing, the substitution of one metal for another, hidden corrosion in gas cylinders, ferro-concrete and the armouring of cables, and so on. X-ray examination also proved very effective during the war with regard to explosives, particularly in relation to enemy ammunition, the exact composition of which we did not know. Most of this work was carried out by the Research Department at the Royal Arsenal, Woolwich.

In the case of timber, different varieties absorbed X-rays to different degrees. X-rays were turned to good account in this connection during the war in the examination of timber for aircraft at a time when the submarine was endangering the country's supplies of high-grade timber, such as spruce and Oregon pine. The result of this was that designs were got out for building up aeroplane parts from smaller timber. In using smaller timber for struts and spars much of the workmanship was completely hidden from view, and it was impossible to ascertain the quality of it except by X-rays. Wood was very transparent to X-rays, and thicknesses up to 18 in. could be dealt with very rapidly. Another application of the rays was in examining the behaviour of the built-up structure while it was being tested, and it was possible to observe which parts collapsed first in the hidden structure as the material was put under test. Radiographs taken of built-up structures in this way threw an astonishing light on the behaviour of built-up aeroplane parts.

Other industrial applications of X-rays were in the manufacture of carbon and graphite brushes for electrical machinery, insulators, &c. Again, one of the gravest troubles encountered in the manufacture of optical glass was the destructive action on the molten glass of the fire-clay pot, and it was found that this was due to the presence of iron and other impurities in the clay of which the pots were made. It was possible by X-ray records to sort out the good pots from the bad ones, and so save considerable expense in spoiled glass. Another use to which radiography was put during the war was the examination of the electrically-heated clothing of airmen in order to ascertain where the wiring had failed, whilst the examination of the distributors of magnetos, in order to avoid taking the apparatus to pieces, was yet another application.

The ideal aimed at in X-ray photography was to make it as easy and automatic as taking an ordinary photograph. The present limitations of the process in metallography were prescribed largely by technique and equipment, and great improvements would have to be made if it were to become a commercial process in heavy engineering. Adequate means would have to be found to reduce the length of exposure, and attention would also have to be paid to the production of heavier X-ray tubes and higher voltages, or more sensitive screens and plates. All experience tended towards demanding higher voltages. The Coolidge tube worked at 180,000 volts, preferably less, but the voltage could be increased to 300,000 by lengthening the arms and immersing the whole tube in oil. If there were a demand for it, no doubt the electrical engineer would overcome the difficulties of supplying 500,000 or more volts, as transformers had been made for such a voltage. A single-phase transformer, however, for 1,000,000 volts would have dimensions of 13 ft. by 9 ft. by 10 ft. high, the terminals would be 28 ft. high, the weight 20 tons, and the cost £10,000. Heavier currents would demand more elaborate cooling devices, and probably glass tubes would have to go. Silica tubes might be the alternative, or even metal tubes might be resorted to. Such tubes would probably be radically different in design, and attempts would have to be made to improve the deplorable inefficiency of the whole apparatus. Again, great improvements in fluorescent and photographic plates were called for. No screen was available which would permit the examination of more than a quarter of an inch of steel; photography had to be resorted to, and the time taken might be prohibitive, at any rate for routine mass inspection. The photographic plate only registered about 1 per cent. of the X-rays passing through it, and progress had been in the direction of thickening the emulsion or loading it with more silver. Any X-ray plate was far more sensitive to visible light than it was to X-rays, but it should be possible by suitable improvements in fluorescent screens to lessen the exposure considerably. There were several developments in that direction already.

In conclusion, Major Kaye said the subject of industrial radiology was young, and although progress had been rapid, care must be taken not to claim too much for it. From such experience as there had been, it could be said that the method had settled down to be a valuable laboratory tool to supplement other methods of testing materials, and the existence of the method had not been without a stimulating effect upon the standard of workmanship in various directions. He, therefore, asked his audience for its moral and material support for the scheme of an Institute of Radiology in London.

LEGAL.

Bailey v. Lumby.

At Dewsbury County Court, on April 27th, His Honour Judge Bairstow, K.C., gave judgment in a case in which John William Bailey, haulage contractor, Staincliffe, claimed an account of alleged partnership dealings with Charles Walton Lumby, electrical engineer, of Firth Place, Shipley, and the winding-up and dissolution of the alleged partnership. Plaintiff alleged that the parties entered partnership in August, 1920, each undertaking to put in £600 within three months, the business to be known as the Staincliffe Engineering Co. They were to share the profits equally, and Mr. Lumby was to receive also £5 per week for working at the garage. The defendant denied that there was a partnership or that any agreement had been drawn up and signed. His Honour gave judgment for the defendant, holding that there was no written agreement, and that if an agreement had been proved he would have concluded that there was no partnership to dissolve, because there had been no carrying on of business. He gave the defendant costs also.

The Nash Fish Hydrophone.

(*Continued from page* 512.)

The Royal Commission on Awards to Inventors, sitting at Martlett House, Bow Street, London, on Monday, resumed the hearing of a claim which was made on behalf of Mr. G. H. Nash, C.B.E., chief engineer of the Western Electric Co., Ltd., and Messrs. E. R. G. Penny, R. A. Mack, and B. B. Grace, three other employés of the company. It was a claim for the hydrophone known as the "Nash Fish," which it was submitted, practically destroyed the danger of the German submarines during the war.

Mr. Temple Franks presided in the absence owing to illness of Mr. Justice Sargant.

Mr. Hunter Gray, K.C., said the claimants' work was purely spontaneous and at the company's own expense. He was informed by Mr. Nash that he had spent over £3,000 of his own money, and from the time he started until 1919 he never received a penny either by way of award or wages.

The Chairman: What do you say they expected to get out of this voluntary work? Were they expecting an arrangement by which they were to be remunerated, or to get work for the company?

Mr. Gray said he believed the work was done for patriotic reasons primarily. So far as he knew, no claim had been made except to this Commission. The claimants were all British-born subjects.

At the request of the Chairman, Mr. Gray proceeded to refer to the main features of the invention, and said he was going to submit that the service which had been given by these claimants was probably the biggest service that had come before the Commission. Considering that something like a million tons of shipping was lost per month, not to speak of the number of lives that were lost, he submitted that this was a very special case, and that nothing less than £100,000 should be considered, having regard to all the circumstances of the claimants' work, the enormous use that had been made of it, and the valuable results which had been obtained by this invention. The Western Electric Co. would not have any of the award, nor did it ask for any.

The Chairman: It is a claim for past services, not for the use that may be made by the Government of the invention in the future?

Sir Arthur Colefax: We will accept an award for future user, but we do not contemplate that there will be any.

The Chairman: It ought to be made clear whether any award given is a complete indemnity.

Mr. Gray: On behalf of the claimants I accept that.

The Chairman: I understand that there was no arrangement between the claimants and the Admiralty with regard to remuneration, but the company were to construct the apparatus. Did the company pay the claimants any commission?

Mr. Gray: No, not at all; the claimants had their salary as officials of the company, and had nothing from the orders executed by the company.

Sir Arthur Colefax: The Western Electric Co. got a monopoly of the supply of these equipments.

It was mentioned that there were orders for 400 or 500 sets.

Mr. G. H. Nash, one of the claimants, was called to give evidence, and explained in detail what his invention was and the use which was made of it by the Admiralty.

Cross-examined, witness said he knew that the Admiralty had made official reports on the sinking of German submarines, and it did not surprise him that these reports did not give one single instance of a submarine being sunk by the use of the "Nash Fish." It might be that there were a number of sinkings which were credited to some other device. This invention had nothing to do with his work as chief engineer of the Western Electric Co.; he carried out his studies in connection with it in the evenings and during week-ends. It was not true that he was indebted to anyone connected with the Admiralty for any success that he might have obtained by the invention.

The Chairman: The case for the Admiralty is as to the amount of the award?

Sir Arthur Colefax said that was so. He was not questioning that Mr. Nash was both industrious and ingenious. But the result of his invention did not, in the view of the Admiralty, prove itself of greater advantage than other means they had of detecting submarines. This invention was not responsible in any case for submarines being sunk, and that was the Admiralty's official view. No doubt the submarines were hunted by the help of the "Nash Fish," and there were other inventions which were equally good. Further, they contended that although Mr. Nash might have developed these matters separately, they also had in the Admiralty got all that he had got, otherwise than through him. They had been developing the matter before he commenced.

The Chairman said that whatever the Admiralty had in their workshops, they did allow this particular means of protection from submarines to be developed, and they did not follow out their own ideas which they commenced.

Sir Arthur Colefax admitted that there were one or more developments of this "Nash Fish" which they put into use. He was told that out of some 3,000 vessels fitted with detecting means not more than 200 were fitted with anything that was traceable to Mr. Nash. The Admiralty had others working along these very lines, and they thought the other devices were quite independently developed and brought to a state of perfection equal to anything that Mr. Nash did, and the Admiralty had paid a substantial sum in respect of these inventions. He agreed that Mr. Nash and the other three claimants were the first to produce a hydrophone which was capable of being towed at speed and giving some directional indication of a submarine if the latter was making sufficient speed or sufficient noise. But his case was that by the time Mr. Nash's hydrophone was put into use the German submarines had learned to go slow when they were being hunted, and also to become much less noisy. He was prepared to admit that although there were no cases of a submarine being sunk by the use of this appliance it was of service in harassing the submarine. At the same time there were equally effective means for doing this. The Admiralty had, some time ago, considered what should be done with such of those appliances as they had, and they had decided that there should be no renewals.

Mr. Hunter Gray said he could claim that whatever part of the Admiralty's appliance was old the claimants added parts which made it a success, and those parts had not existed before. All the information which Mr. Nash got he learned for himself, and he did not get any of it from the Admiralty.

The C[illegible] then adjourned.

The Bastian Electric Co., Ltd.

The petition of W. F. N. May and Another for an order for the compulsory winding-up of this company was before Mr. Justice P. O. Lawrence in the Companies Winding-up Court on Tuesday.

Mr. Dighton Pollock, for the petitioners, said they were judgment creditors, and the petition was opposed by the company, the allegation being that the petitioners were really acting as agents for a company called May & Padmore, Ltd. He submitted that the whole of the opposition was irrelevant.

Mr. Schwabe, K.C., for the respondent company, said their case was that the petitioning creditors were the representatives of a company with which the respondents were in litigation, and in respect of which the respondent company had a much larger claim than the petitioning creditors. He asked that the company should not be wound up while litigation was proceeding, and said that every other creditor was opposed to the petition.

He read an affidavit by Mr. Charles Bastian, who denied that the company was insolvent. He related how an agreement was made with Messrs. May & Padmore, Ltd., to manufacture certain patented articles for the company, and how under this agreement three of the directors of May & Padmore, Ltd., joined the board of the Bastian Electric Co., Ltd. It was also provided that May & Padmore, Ltd., should be responsible for the financial side of the Bastian company's business. In March, 1920, disputes arose, as the result of which the Bastian company was unable to carry on business, and a receiver was appointed. Since then, however, the financial position of the company had improved, and it had secured an important Admiralty contract for the supply of electric heating apparatus parts.

An affidavit by the petitioners was read by Mr. Pollock. They said there was a perfectly good defence in the litigation on the agreement. They denied that May & Padmore, Ltd., guaranteed to supply credit to the Bastian Co., and they were not seeking to crush the latter company out of existence so as to be in a position to manufacture electric heating apparatus.

Mr. Pollock said the winding-up petition was presented in March last, and the writ in the action was dated April 13th. The relief claimed was a declaration that the agreement was valid and subsisting, damages for alleged breach of the agreement, and an injunction restraining the defendants from advertising or inserting certain notices in the electrical and other trade papers.

His Lordship said there must be a meeting of the creditors of the company to decide whether there should be a winding-up and whether that winding-up should be compulsory or voluntary. The company was to furnish to the Official Receiver a complete list of the names and addresses of the creditors and the amounts of their claims. The Official Receiver would preside, and he would report the result of the meeting to him (the judge). The petition would be adjourned to await the result of this meeting.

Dore *v.* Hackney Borough Council: Judgment.

Judgment was delivered in the case of Dore *v.* Hackney Borough Council at the North London Police Court by Mr. Forbes Lankester, K.C., on Tuesday. The circumstances have been reported briefly already. The Council was summoned for making default in supplying electric power to the house of the plaintiff as required under the Hackney 1893 Electric Lighting Order. The borough electrical engineer was satisfied that the work had been properly done, and the committee was anxious to give the supply, but acting on the orders of the Electrical Trades Union the Council's employés refused to connect because the work was not done by Trade Union labour but by a man who was his own master.

The magistrate, in giving judgment, said (as reported in the *Daily Telegraph*) that the Council had either to yield to the threat of the trade union or run the risk of dislocating the business of the borough depending on electric light and power. It chose the first-named alternative. It was not for him to approve or disapprove that decision. His only duty was to say whether in the circumstances he was of opinion that the default was caused by inevitable accident or *force majeure*. He held that the default was not due to inevitable accident, and it remained for him to consider what was the meaning to be placed on the expression *force majeure*. It was first used in the model electric lighting orders approved by the Board of Trade, and imported from the orders into the Electric Lighting Clauses Act of 1899. He could find no decision as to the meaning of the expression in these orders, or where the words were used in any statute; but there were several decisions as to its effect in commercial contracts. So far as he could find it had been held to apply only to physical or material constraint outside the control of the contractor. It had been held to apply to strikes actually proceeding, to war, to breakdown of machinery, but never to fear, however reasonable, of the consequences of threatened action. It was to be observed that the threat, if acted upon generally (and he was told that this trade union controlled the action of electrical workers throughout the kingdom), would deprive all men in the position of Mr. Cant of an honourable and legitimate livelihood, whilst it avowedly amounted to a claim on the part of the union to dictate to all their fellow-subjects the class of persons they should employ to do private electrical work on private premises. Some might regard such a threat as high-handed and insufferable tyranny on the part of the union. It was not for him to say; he was only required by the statute to say whether he was of opinion that a threat of this kind amounted to *force majeure* within the meaning of the proviso in the order. In view of the decided cases he was of opinion that the Council's default was not due to *force majeure*, and that the default could not be excused. He therefore fined the Council 5s. per day for nine days (£2 5s.) and ordered it to pay 20 guineas costs. The case was of very wide application, and he should assist any appeal to the High Court, as he thought that if the meaning of the expression *force majeure* was to be extended it should be done by the High Court, and not a Court of summary jurisdiction.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Septon-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

11,152. "Electric switches." Butlers, Ltd., and A. Reeves. April 18th.
11,167. "Apparatus for recording telephone calls." H. Rawson. April 18th.
11,182. "Combined electric safety devices and insulators." I. Valen. April 18th. (Norway, April 16th, 1920.)
11,192. "Fusible safety cut-out for electric motors." B. Platschick. April 18th.
11,206. "Apparatus for obviating over-regulation in automatic regulating devices." Siemens-Schuckertwerke. April 18th. (Germany, April 17th, 1920.)
11,235. "Electric lamps to be carried on the person." G. Oldham and J. Oldham. April 18th.
11,236. "Galvanic batteries." G. Oldham and J. Oldham. April 18th.
11,237. "Electric cut-outs and resistances." G. Oldham and J. Oldham. April 18th.
11,238. "Electric switches." G. J. Sutton. April 18th.
11,273. "Electric transformer regulating switches." E. Thomas. April 19th.
11,274. "Telegraph keyboard perforators." A. C. Booth and A. S. Wilmot. April 19th.
11,286. "Oscillating brush gear for electrical machines." F. S. Thwaites. April 19th.
11,289. "Tungsten arc lamps." Patent-Treuhand Ges. fur Electrische Gluhlampen. April 19th. (Germany, April 28th, 1920.)
11,299. "Automatically controlled electrical generating plants." A. W. Slater. April 19th.
11,301. "Electric contact plugs." H. Durheim. April 19th. (Switzerland, April 19th, 1920.)
11,312. "Telephone repeaters." Western Electric Co., Ltd. (Western Electric Co., Inc.). April 19th.
11,323. "Electrically actuated mechanism for producing sliding or rotary motion." E. N. Bray. April 19th.
11,326. "Electric switches." Compression Starter & Switchgear Co., Ltd., and R. Lomax. April 19th.
11,349. "System of pole-changing for polyphase induction motors." O. T. Blathy. April 19th. (Hungary, April 19th, 1920.)
11,356. "Electric switch." L. Horvath and G. von Martiny. April 19th. (Hungary, May 8th, 1920.)
11,363. "Apparatus for converting heat into electrical energy." F. E. Beeton. April 19th.
11,375. "Electric battery." K. Warnon. April 20th.
11,388. "Telephone steriliser." J. A. V. Frew, S. Graham, and T. B. Macmillan. April 20th.
11,392. "Anti-vibration devices for incandescent electric lamps, &c." J. R. Thompson. April 20th.
11,396. "Dynamo-electric machines." P. Forster. April 20th.
11,398. "Electric switch." G. W. Humphry. April 20th.
11,402/3. "Means for improving current-carrying capacity of three-phase alternating current cable systems." A. M. Taylor. April 20th.
11,412. "Recording, reception, and reproduction of sounds." O. Bothe. April 20th. (Germany, April 20th, 1920.)
11,427. "Hand sets." Western Electric Co., Ltd. April 20th.
11,433. "Electric horns for motor cars, &c." H. J. Sims. April 20th.
11,446. "Control of electrically operated fluid compressors." Westinghouse, Brake & Saxby Signal Co., Ltd. April 20th. (United States, August 31st, 1920.)
11,467. "Electric device for treating air." E. R. Case. April 20th.
11,469. "Electric geysers." A. F. B. Andrew. April 20th.
11,473. "Electric fire, burglar, &c., alarms." Bayerische Vereinsbank. April 20th. (Germany, April 20th, 1920.)
11,475. "Art of increasing efficiency of electro magnetic radiation." W. E. Hitch. April 21st.
11,501. "Perpetual motion or magnetically propelled power generator." A. E. W. Maseyk. April 21st.
11,511. "Containers for electric batteries, &c." S. W. Cox. April 21st.
11,516. "Automatic cut-out or switch for electrically-heated apparatus." H. Jaggi-Zumbuhl. April 21st.
11,517. "Containers for electric batteries, &c." New Eccles Rubber Works, Ltd. April 21st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1919.

21,542. "Signal or call apparatus for restaurant tables and the like." A. M. Bree. September 2nd, 1919. (161,204.)
26,990. "Electrical ignition means for internal combustion engines." E. C. White and G. Davenport & Co., Ltd. November 3rd, 1919. (161,208.)
27,123. "Glow or incandescent electric lamps." G. Malatesta. November 4th, 1919. (161,211.)
27,150. "Methods and means for covering metal cores in the manufacture of electrodes." W. H. Boorne and W. Darge. Novermber 4th, 1919. (161,212.)
30,119. "Induction motors." Colner Elektromotorfabrik, J. Bruncken. September 25th, 1918. (Addition to 136,156.) (140,745.)
32,495. "Telephone receivers, transmitters, and other electric or magnetic acoustic or vibratory apparatus." S. Hockly. December 29th, 1919. (161,241.)
32,783. "Electric generators and motors." R. Ranklin and Van Randen and Co., Ltd. December 31st, 1919. (161,245.)
32,880. "Apparatus for waving or curling the hair." Quain Electric Co., Ltd., and J. R. Spink. December 31st, 1919. (161,249.)

1920.

64. "Electric battery." P. Odion and A. Cayrol. April 25th, 1914. (137,324.)
66. "Process for the manufacture of an electric insulating material." E. F. A. Bultemann. January 29th, 1918. (137,326.)
151. "Signalling systems applicable to wireless receiving systems and other purposes." British Thomson-Houston Co., Ltd. (General Electric Co.). January 2nd, 1920. (161,256.)
226. "Electric and like kettles." R. W. Coan. January 3rd, 1920. (161,263.)
254. "Electric oscillation arcs." Radio Communication Co., Ltd., and B. Binyon. January 3rd, 1920. (161,266.)
431. "Telephone transmitters." V. F. Feeny (Magnavox Co.). January 6th, 1920. (161,277.)
520. "Dial switches as used in automatic telephone or like systems." Automatic Telephone Manufacturing Co., Ltd., S. R. Smith, and J. Savin (partly communicated by Automatic Electric Co.). January 7th, 1920. (161,283.)
697. "Generation of electricity by means of the rise and fall of tides." R. I. Ward. October 8th, 1920. (161,295.)
729. "Mine signalling or like systems in which the main signals are given by a number of impulses transmitted in succession." Automatic Telephone Manufacturing Co., Ltd., and C. Remington. January 9th, 1920. (161,297.)
1,314. "Electric motor driving arrangements." Siemens Bros. Dynamo Works, Ltd., and J. F. Crowley. January 15th, 1920. (161,313.)
1,830. "Sparking plugs." R. F. Hall. January 20th, 1920. (161,327.)
2,427. "Suspending means for electric light fittings." F. I. Green. January 26th, 1920. (161,353.)
5,807. "Electrical accumulators." Saunders Electrical Co., Ltd., and C. Saunders. February 26th, 1920. (161,404.)
8,519. "Sparking plugs." J. E. Barrows. March 23rd, 1920. (161,429.)
11,278. "Radio navigational systems." G. P. Grenfell, J. Erskine-Murray, J. Robinson, and H. L. Crowther. April 23rd, 1920. (161,448.)
11,313. "Electro-magnetic wave receiving systems." J. Robinson and H. L. Crowther. April 23rd, 1920. (161,449.)
18,235. "Continuous current gyroscope motor." F. Krupp Akt.-Ges. November 18th, 1915. (146,302.)
19,176. "Transmission dynamometers." F. Krupp Akt.-Ges. July 7th, 1920. (147,137.)
19,443. "Electric current interrupters." Firm of C. Zeiss. May 28th, 1918. (147,485.)
19,844. "Electric transformers or self-induction coils." Soc. Francaise Radio-Electrique. May 30th, 1915. (147,801.)
23,979. "Electric distribution or fuse boards and the like." H. B. Prentice. August 17th, 1920. (161,497.)